



**ADM Institute for the
Prevention of Postharvest Loss**
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN



Progress Report 2011

INTRODUCTION	3
Letter from the Director	3
Narrative Timeline	4
ORGANIZATIONAL STRUCTURE	7
Steering Committee	7
External Advisory Board	7
HARNESSING RESEARCH EXPERTISE	8
Seven Research Projects	8
Four Case Studies	26
Seed Research Projects	30
ENGAGING STUDENTS	34
Student Involvement	35
BADM 380	35
International Course Development	36
Engineering Sustainable Solutions to Postharvest Loss	37
Monitoring Carbon Dioxide in Storage	40
OUTREACH	43
Conferences and Symposia	44
Press Articles	45
Publications	50
Postharvest in the News	51
Periodic Updates	52
Website Development	53
EXTERNAL ADVISORY BOARD MEETING	56

Agriculture has always played an essential role in economic development. As we move into the 21st century, that role continues. With population and income growth, the need for food is likely to double in the next 30 years. And that increased supply needs to be achieved with no more, and hopefully less, impact on the environment.

One attractive means to potentially increase the effective supply of food is to ensure that food systems are most effectively linking agricultural production to consumers. Although the extent of loss varies by commodity, region, and agricultural system, reducing postharvest loss offers considerable potential for gain to society.

In 2011, the ADM Institute for the Prevention of Postharvest Loss was established at the University of Illinois, with the support of a generous \$10 million gift commitment from the Archer Daniels Midland Company. During this first year of the Institute, we have collaboratively made significant progress in both creating the **Institute's organizational structure and goals and in initiating active research and outreach programs.** The report which follows describes those activities and highlights key milestone attainment.

We hope that you find the contents of this report to be of interest. If you would like additional information, please feel free to contact me at 217/333-5115 or by email at postharvestinstitute@illinois.edu.

Sincerely,

Steve Sonka
Director



Since its inception in January, 2011, the ADM Institute for the Prevention of Postharvest Loss has set out to attract international attention to the issues surrounding postharvest loss and increase research efforts focused on loss reduction. In one year, we have made tremendous strides toward achieving this goal. The Institute has initiated research efforts in the United States, India, and Brazil; has presented and sponsored conferences worldwide; and has instituted efforts to attract faculty and students to apply their expertise to this important societal issue. Additional information regarding these and the other initiatives noted below is provided throughout the remainder of this report.

In the early months of the Institute, case studies were initiated in India focusing on crops and regions which are illustrative of the prevalent problems in postharvest loss. The titles and collaborating entities for the studies are:

- *Understanding Rice Losses, Tamil Nadu: Marketplace Literacy Project*
- *Baseline to Study the Value Chain of Maize in Rajasthan: Indian Society of Agribusiness Professionals (ISAP)*
- *Mapping the production system and the supply chain and study the crop losses of Black Gram in Maharashtra and MP: MART*
- *A study on pigeon pea postharvest loss in Maharashtra: Maharashtra Hybrid Seed Company (Mahyco)*

Also, at this time, the Institute began its visioning processes. Results of this process include:

- Ratification of the Institute Vision Statement: to serve as an international information and technology hub for evaluating, creating and disseminating economically viable technologies, practices and systems that reduce postharvest loss in staple crops such as rice, corn, wheat, and oilseeds.
- **Specification of the Institute's four functions as to:**
 - Conduct transformational R&D activities,
 - Establish strategic partnerships,
 - Establish a post-harvest loss website, and
 - Develop training courses.
- **Definition of the four key themes that frame the Institute's research portfolio:**
 - Measurement and Technology Development
 - Systems Informatics and Analysis
 - Policy Analysis
 - Education, Training and Information Transfer

An organizational structure was crafted within the Vision process as a tangible means to achieve the purposes of the Institute. An internal Steering Committee, comprised of faculty from across campus, and an External Advisory Board, with leaders from around the globe and throughout the sector, have been formed. (continued)

By Fall, the Institute issued a Request for Proposals to targeted faculty at the University of Illinois. After careful consideration and discussions with the Steering Committee, interested faculty from across the campus were invited to propose research initiatives for the Institute. Ten proposals, with funding requests exceeding \$4 million, were submitted and seven proposals were selected. Their areas of focus are:

- *Appropriate Technology Development and System Integration for Post-Harvest Loss Prevention*
- *Concurrent Science, Engineering, and Technology for the Prevention of Postharvest Loss*
- *Education, Training and Information Transfer to Minimize Postharvest Losses – Scientific Animations*
- *Managing Grain Losses in Continuous Cropping Systems of the Tropics through On-Farm or Cooperative Storage*
- *Measurement, Documentation and Postharvest Processing for the Prevention of Postharvest Losses of Soybeans and Corn*
- *Supply Chain Policy and Strategy Analysis for Prevention of Postharvest Loss*
- *The nature of small landholder agriculture in the Brazilian states of Sao Paulo and Parana and implication for understanding post-harvest loss*

The research awards total \$2.1M with faculty represented in the Colleges of Liberal Arts, Business, Engineering, and Agriculture, Consumer and Environmental Science. Throughout the year, the institute has been working hard to form collaborations with entities around the world. The director of the **ADM Institute spoke on “Innovations to Minimize Post Harvest Loss” at the Symposium on “Opportunities for Innovation in Indian Agriculture Sector”** in Chicago, IL on October 4, 2011. The Institute has hosted international scholars and facilitated them getting to better know our students and faculty (Examples include: Rikin Gandhi, Chief Executive Officer, Digital Green, visited campus October 17, 2011; Ismael Roig, Vice President and President, Asia-Pacific (ADM), visited campus May 6, 2011; Rajeev Dar, Chairman, Indian Society of Agribusiness Professionals, visited campus August 25, 2011 and October 5, 2011 along with Dr. Satish Chandra, Director of Agricultural Extension).

The Institute will be participating in several conferences in 2012 including the 22nd Annual IFAMA World Forum and Symposium in China. Furthermore, relationships are being identified, defined and explored through the sponsored research projects and through the External Advisory Board **relationships. At the Board’s inaugural meeting on February 6th, avenues for collaboration were discussed.**

(continued)

Finally, the Institute has developed a robust website to present findings, updates, and periodic reports. The website is updated weekly with our publication, *PHL in the news*.

The following Progress Report presents more information on the progress the ADM Institute has made in its first year. The Report begins with an overview of the organizational structure. Thereafter, it is organized according to several key outcomes discussed and developed in discussions with ADM in the fall of 2010: harnessing research expertise, engaging students in research and project efforts, and advancing efforts to reduce postharvest loss.



Director

Steve Sonka is director of the Institute and an emeritus professor of agricultural management at the University of Illinois. At the University of Illinois, he was the first faculty member to hold the Soybean Industry Chair in Agricultural Strategy. His administrative responsibilities have included serving as the Vice Chancellor for Public Engagement and being the first Director of the National Soybean Research Laboratory, a multidisciplinary institution focused on furthering the effectiveness of soybean research. A co-founder of the Centrec Consulting Group, LLC, in Savoy, Illinois, he was a partner there for more than 20 years. An economist reared on an Iowa family farm, his scholarship emphasizes strategic change and decision making. An author or coauthor of over 200 publications, his international experiences include consulting and lecturing on every continent except Antarctica.

External Advisory Board provides strategic guidance and assistance to the Institute. The Board meets annually, and is comprised of members representing various academic, commercial, governmental and non-governmental institutions with strong interests and experience in postharvest loss issues.

Chair	Robert Easter	Former Chancellor, University of Illinois
	Usha Barwale-Zehr	Chief Technology Officer, Mahyco Seeds
	Carlos Campabadal	Grain Industry Consultant, Asociación Americana Soys-IM
	Ashok Gulati	Chairman, Commission for Agricultural Costs and Prices, Ministry of Agriculture, Government of India
	Hans Joehr	Corporate Head of Agriculture, Nestle
	Dirk Maier	Professor and Head, Department of Grain Science and Industry, Kansas State University
	Domingo Lastra	Vice President, Business Growth, Archer Daniels Midland Company
	Kent Miller	Director, Global Strategic Quality, John Deere
	Steve Mills	Sr. Executive Vice President, Archer Daniels Midland Company
	Arlene Mitchell	Deputy Director, Agricultural Development/Access and Market Systems, Bill & Melinda Gates Foundation
	Daniel Queiroz	Department of Agricultural Engineering, Universidade Federal de Viçosa

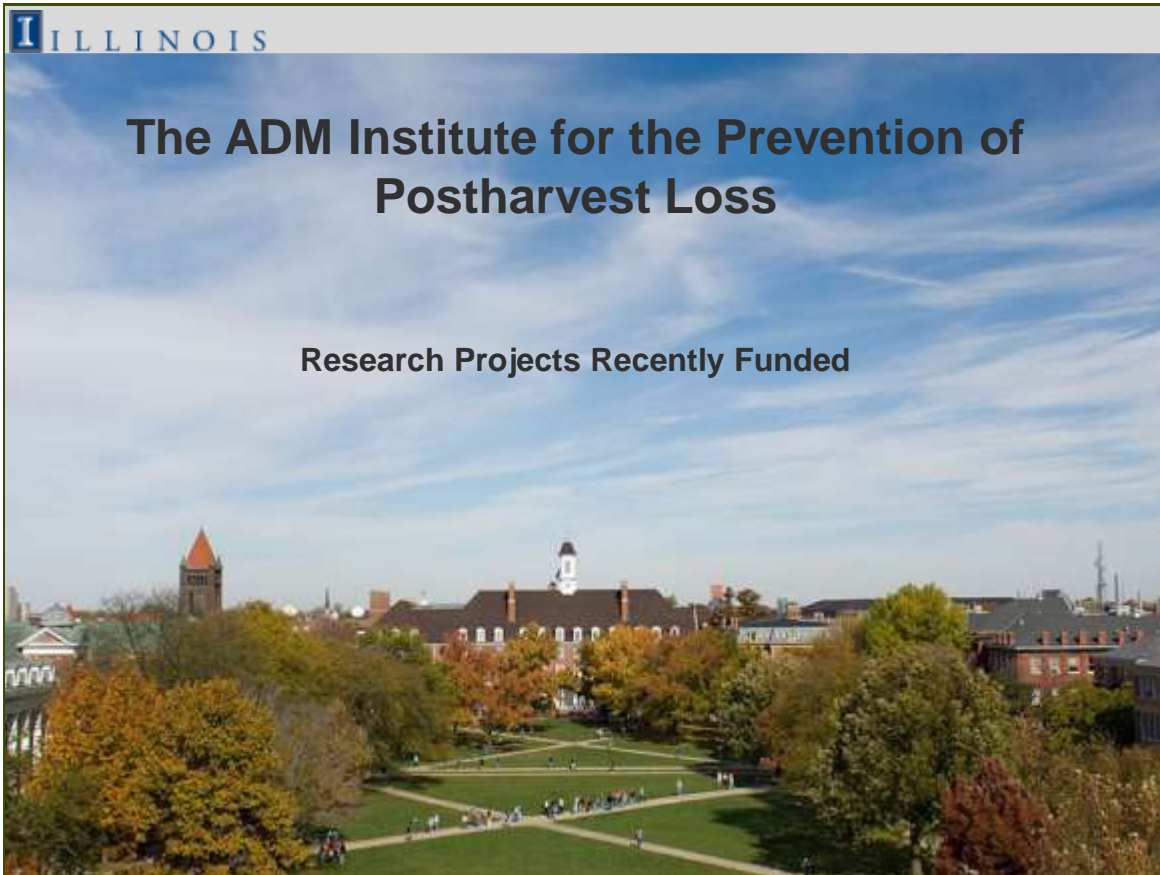
Steering Committee provides guidance and oversight of the Institute. The Committee is comprised of five University of Illinois members and an ADM representative.

Andrew Alleyne	College of Engineering Ralph M. and Catherine V. Fisher Professor, COE Associate Dean for Research (sabbatical)
Sophi Martin	Manager of Research, College of Engineering Corporate Relations (participating for Andrew Alleyne)
KC Ting	Professor and Head, Department of Agricultural and Biological Engineering
Peter Goldsmith	Associate Professor and Interim Director of the Food and Agribusiness Management Program (FAM) Executive Editor, The International Food and Agribusiness Management Review (IFAMR)
Steve Mills	Senior Executive Vice President, Archer Daniels Midland Company (retired)
Udatta Palekar	Associate Professor of Business Administration and Director of the Supply Chain Management Program

Seven Funded Research Projects

The Institute has recently funded seven international research projects aimed at finding innovative ways to reduce postharvest loss. These projects are described in the following slides.





Development and Selection Process

- Expand pool of interested & relevant faculty
 - Within and concurrent with visioning process
- RFP issued to targeted faculty
 - Considerable follow-up with Director and Steering Committee
 - Targeted faculty encouraged to reach out to collaborators
- Research teams submitted expressions of interest
 - Met with Steering Committee to review and shape proposals
- 10 proposals submitted, requesting \$4 million in funding
- Steering Committee selected 7 proposals, totaling \$2.1 million

ILLINOIS

Measurement, Documentation and Postharvest Processing for the Prevention of Postharvest Losses of Soybeans and Corn

Investigators:
M.C. Danao, R.S. Gates, S.R. Eckhoff, and M.R. Paulsen
Department of Agricultural and Biological Engineering



Measurement, Documentation and Postharvest Processing for the Prevention of Postharvest Losses of Soybeans and Corn

Objectives

- To determine the extent and cost of harvest losses for soybean and corn farmers
- To measure the ambient conditions, temperature and airflow distribution, and carbon dioxide buildup during truck transport and within graneleiro storage and develop a CFD model to develop guidelines for proper handling, transportation, and storage
- To design, test and analyze costs of implementing alternate structures for on-farm storage

**Measurement, Documentation and Postharvest
Processing for the Prevention of Postharvest Losses of
Soybeans and Corn**

Methodology

- Travel to 10-15 farms across Jatia, Goias and Sinop, Mato Grosso to measure pre-harvest, combine header, and threshing/cleaning losses. Collect information about combines.
- Develop an instrumentation system (CFD – combined heat and mass transfer model) to monitor ambient conditions, temperature, humidity, airflow and carbon dioxide levels.
- Calculate the costs and do small scale field tests to determine feasibility of using alternate storage structures.



**Measurement, Documentation and Postharvest
Processing for the Prevention of Postharvest Losses of
Soybeans and Corn**

Outcomes

- Complete four publications and two literature reviews
 - Combine harvest loss
 - Use of advances in wireless systems for grain monitoring and graneleiros trucks
 - FCD simulation models for different aeration strategies and ambient conditions
 - Quality of corn grain stored in silo bags
 - Design, implementation and testing of low-cost aerated on-farm storage units
 - Cost analysis of phl
- Press releases
- Instructional materials
- Collaborations



**Measurement, Documentation and Postharvest
Processing for the Prevention of Postharvest Losses of
Soybeans and Corn**

Impact

- In order to be more efficient at mitigating phl, the proposed measurements will point where the main losses seem to be happening.
- The study will provide an important baseline for measuring improvements in grain quality during transport.
- The impact of using better instrumentation and modeling conditions in graneleiros can be measured by a change in practice – the use of appropriate duct sizes and placement and increased operational efficiency.
- The study will provide a storability index - highly useful storage data by location and year - to the CONAB data base.
- The use of silos in Mato Grosso has not been tested; this study will determine the feasibility of this system in the region.



ILLINOIS

Education, Training and Information Transfer to Minimize Postharvest Losses – Scientific Animations Without Borders

Investigators: Barry Pittendrigh, Julia Bello-Bravo, Francisco Seufferheld, and Madhu Viswanathan



Education, Training and Information Transfer to Minimize Postharvest Losses – Scientific Animations Without Borders

Objectives

- To develop a platform for educational materials that can be used to educate low literate learners involved in the postharvest process
- Produce educational materials that use highly detailed animations with voice overlaid in local languages and dialects



**Education, Training and Information Transfer to Minimize
Postharvest Losses – Scientific Animations Without
Borders**

Methodology

- Identify known techniques that can dramatically reduce phl
- Issue two rounds of requests for videos in the first two years
- Prioritize 5-10 videos to be made each year with the following criteria:
 - Cover high impact topics
 - Well elucidated needs assessment
 - Techniques are displayed in a visual manner
 - In locations where there is a need to educate low-literate learners
 - Deployment strategy
 - Topics have broad appeal



**Education, Training and Information Transfer to Minimize
Postharvest Losses – Scientific Animations Without
Borders**

Outcomes and Impact

- Production of videos in a diversity of languages that demonstrate techniques to reduce phl
- Develop a network of collaborators to deploy these videos
- Obtain data from assessments of the impact of these videos on acceptance, penetration, deployment approaches, and changes in behavior
- Ability to scale the project to other areas
- Publishable materials
- Develop novel synergies with other components of the ADM Institute
- Provide extension and outreach groups with educational materials that cause change in behavior



**I**LLINOIS

Supply Chain Policy and Strategy Analysis for Prevention of Postharvest Loss

Investigators: Kathy Bayliss, Dilip Chhajed,
Mindy Mallory, Udatta Palekar

Supply Chain Policy and Strategy Analysis for Prevention of Postharvest Loss

Objectives

- Identify and measure how institutions (government policies, market institutions and local norms) affect the efficiency of markets, the incentives facing supply chain participants, and the loss in crop quantity, quality and income
- Develop supply chain maps detailing the cause and effect relationship between policies and postharvest losses
- Develop tools for targeting phl interventions and develop a method to assess the effectiveness of these solutions in India
- Examine the effect of new infrastructure innovations (e-Choupal) and availability of spot market prices
- Develop a game-theoretic model to understand equilibrium investment decisions

Supply Chain Policy and Strategy Analysis for Prevention of Postharvest Loss

Methodology

- Targeting with Market Efficiency Studies
- Supply Chain Maps
- Incentive System
- Household Surveys



Supply Chain Policy and Strategy Analysis for Prevention of Postharvest Loss

Outcomes and Impact

- White Papers discussing which interventions have the most potential for preventing phl
- Market Data: A cleaned and organized dataset for dissemination
- By identifying the geographic hotspots for post-harvest loss, understanding the incentives for good storage and marketing practices at the household level and among different actors along the supply chain, this project will inform stakeholders of actions which can be taken in terms of the political, cultural, and institutional environments to reduced post-harvest loss in targeted areas.

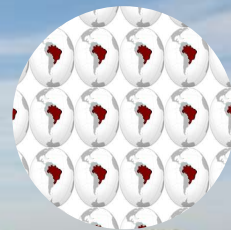
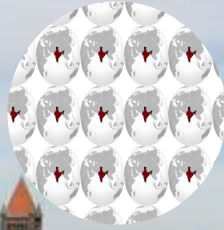


 ILLINOIS

Appropriate Technology Development and System Integration for Post-Harvest Loss Prevention

Investigators:

Ximing Cai, Imad Al-Qadi, Khaled El-Rayes, Youssef Hashahs, Praveen Kumar, Wen-Tso Lui, Paramita Mondal, John Popovics, Junho Song, Dan Work, CEE, Mary-Grace Danao (ABE), Steven Eckhoff (ABE)



Appropriate Technology Development and System Integration for Post-Harvest Loss Prevention

Objectives

- Investigate appropriate technology development and system integration for phl prevention with a focus on near-farm storage facilities, which cause a large portion of phl
- Develop innovative and appropriate technologies for phl prevention with all structural components in the supply chain of a particular commodity
- Design a resilient and reliable multi-echelon supply chain for a particular commodity
- Conduct sustainability assessment, including the technical, environmental, and socioeconomic aspects of the technology adoption and the design of the supply chain
- Make recommendations of solutions for two case studies in India and Brazil based on the technology development, system design and assessment

Appropriate Technology Development and System Integration for Post-Harvest Loss Prevention

Methodology

- Four stages of project activities:
 - Specific context appraisal
 - Assessment and deployment on one commodity in Haryana and Tamil Nadu, India
 - Assessment and deployment of one commodity in Brazil
 - Comparison and wrap-up
- Technologies to investigate include:
 - Cheap biological sensors for bacteria, insects, and fungi and physical sensors for moisture and temperature storages
 - Alternative cost-effective materials for storage construction based on available raw materials
 - Optimal storage design including size, site layout, use of limited resources, and innovative conveyance systems, storage and inlet and outlet systems



Appropriate Technology Development and System Integration for Post-Harvest Loss Prevention

Outcomes

- Affordable and effective technologies for adoption
- Comprehensive framework to explore optimal engineering solutions and infrastructure investment requirement to minimize phl
- Guidelines for integrated system design based on recommended structural and information technologies (risk and hazard report)
- Educational development (training courses and UIUC course update)



Appropriate Technology Development and System Integration for Post-Harvest Loss Prevention

Impact

- The deliverables of this project are expected to influence investment priorities of both public and private entities, which will lead to infrastructure improvement and operational efficiency and finally phl reduction.
- The impacts can be quantified by the amount of investments to particular technology adoptions and systems developments, the amount of phl reduction in the various components of the supply chain, and the conservation of resources (land, water, labor ...).
- The impacts may not be materialized during the project period, but can be predicted by data and modeling analysis.



ILLINOIS

Concurrent Science, Engineering, and Technology for the Prevention of Postharvest Loss

Investigators:
Luis Rodriguez, Yogendra Shastri, Yanfeng Ouyang



Concurrent Science, Engineering, and Technology for the Prevention of Postharvest Loss

Objectives

- Develop the platform and modeling framework for using Concurrent Science, Engineering, and Technology (ConSEnt) tools to address the prevention of phl
- Build collaborative connections in India and Brazil for acquisition of country specific data on phl
- Develop and implement a web-based informatics foundation in the prevention of phl
- Perform targeted modeling and analysis for the prevention of phl
- Development of a web-based decision support system for the prevention of phl

**Concurrent Science, Engineering, and Technology for the
Prevention of Postharvest Loss**
Methodology

- Develop collaborations in India and Brazil
- Informatics: Perform a literature review leading to the development of conceptual diagrams indentifying the important components and inter-relationships within the agricultural systems
- Modeling and Analysis
 - Integrated Logistics Network Analysis
 - Agent-based Modeling and Analysis
 - Simulation and Stochastic Optimization Models
- Web-based decision support system integrates the database and the models



**Concurrent Science, Engineering, and Technology for the
Prevention of Postharvest Loss**
Outcomes and Impact

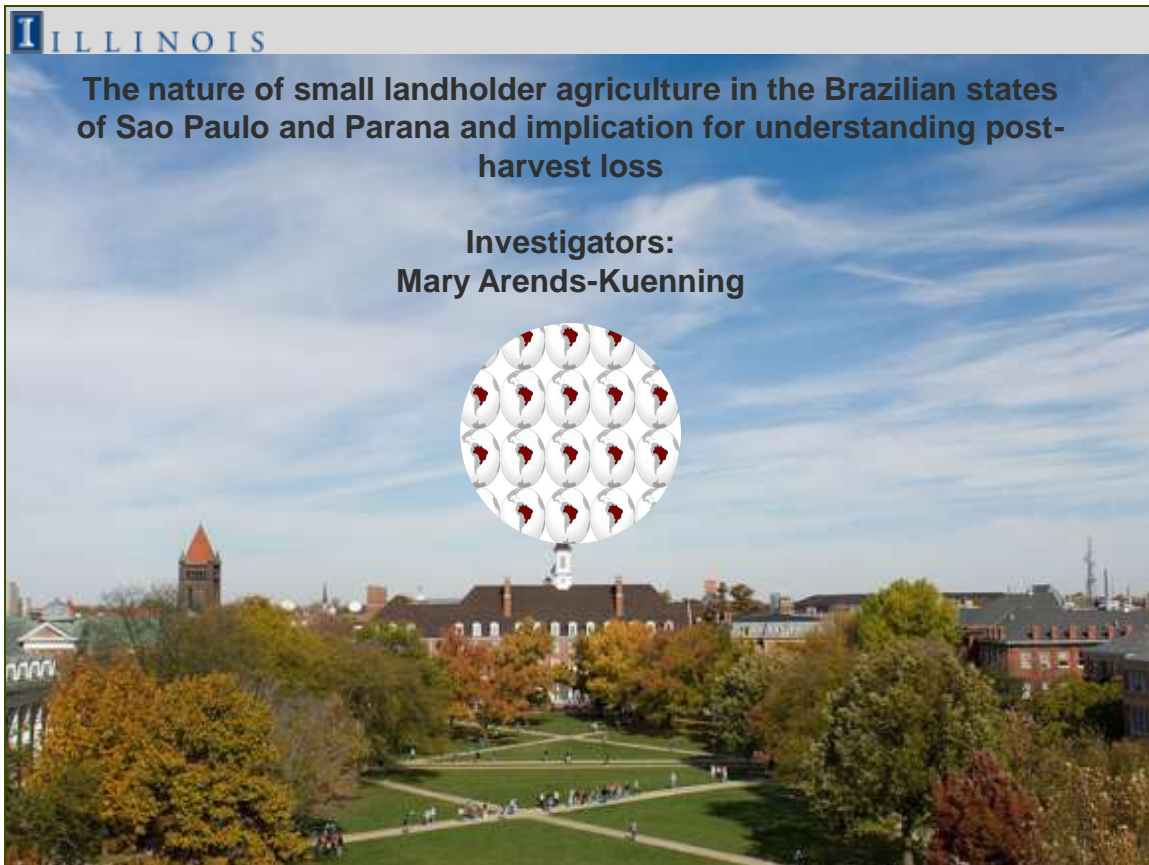

- Novel contributions in reduction and prevention of phl indentified through the ConSEnT platform
- Comprehensive database, quantitative and semi-quantitative models, algorithms, and decision support tools
- Case specific recommendations for phl systems in Brazil and India
- A platform for integration of knowledge and exchange of data and ideas
- In the first two years, quantification of systemic performance measures (cost, material loss, efficiency, resilience...)
- After three years, implementation of analysis-based recommendations on real systems through collaborations with other focus areas to quantify improvements in real systems



ILLINOIS

The nature of small landholder agriculture in the Brazilian states of Sao Paulo and Parana and implication for understanding post-harvest loss

**Investigators:
Mary Arends-Kuenning**



The nature of small landholder agriculture in the Brazilian states of Sao Paulo and Parana and implication for understanding post-harvest loss

Objectives

- Produce report about the nature of phl as it affects smallholders in the states of Sao Paulo and Parana, Brazil
- Key questions:
 - What grains to smallholders produce? To what extent do acreage choices depend on the susceptibility of grains to phl?
 - What is the extent on phl? At what stage of the supply chain does loss occur?
 - Who bears the cost of phl?
 - What are the transaction costs that prevent stakeholders from investing in technology that reduces phl?

The nature of small landholder agriculture in the Brazilian states of Sao Paulo and Parana and implication for understanding post-harvest loss

Methodology

- Interview smallholders, buyers who purchase grains from smallholders, traders, and retailers
- Develop a survey of smallholders in these states to include information about crop acreages, timing of harvests, contracts with buyers, access to credit, and general economic characteristics of the farmers' household



The nature of small landholder agriculture in the Brazilian states of Sao Paulo and Parana and implication for understanding post-harvest loss

Outcomes and Impact

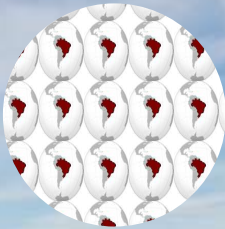
- A report that will consist of a literature review of previous work on phl of smallholders in the region focusing on grains and sugar cane
- A report based on the in-depth interviews with the stakeholders along the supply chain
- A database of information from smallholders
- A research paper analyzing the data from the smallholders, focusing on marketing channel decisions and their implications for phl
- Measure the impact of reducing phl in this setting



ILLINOIS

Managing Grain Losses in Continuous Cropping Systems of the Tropics through On-Farm or Cooperative Storage

**Investigators:
Peter Goldsmith and Altair Moura**



**Managing Grain Losses in Continuous Cropping Systems
of the Tropics through On-Farm or Cooperative Storage**

Objectives

- Be the first to conduct economic research on grain loss under the increasingly common high temperature, high humidity, and high rainfall environments of tropical grain production
- Discover additional impacts of distances and the lack of accessible storage on phl in this climate

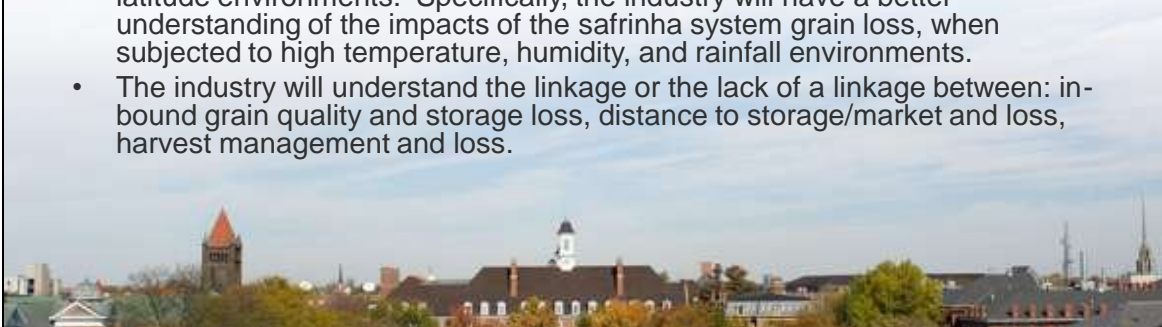
**Managing Grain Losses in Continuous Cropping Systems
of the Tropics through On-Farm or Cooperative Storage**
Methodology

- Robust econometrics results linking weather and loss; distance and loss; storage and loss; harvest management and loss
- Create a systems model of the safrinha, loss, weather, distance interaction with maps highlighting spatial aspects of the problem
- Primary data collection of small panel of farms to measure loss, distance, harvest management, weather and equipment quality
- Descriptive case studies
- Other research methods are still being explored



**Managing Grain Losses in Continuous Cropping Systems
of the Tropics through On-Farm or Cooperative Storage**
Outcomes and Impact

- Establish the ADM PHL Field Laboratory where ongoing systems research on loss would occur in five cooperative farms in Sinop, MT area.
- Initiate research and outreach partnerships among industry, producers, and Embrapa.
- Policy recommendation adoption by Aprosoya, the corn and soybean farmers association of Mato Grosso
- Establish a biannual conference on harvest loss and storage in MT at the Embrapa station
- The industry will have a better understanding of the sources of grain in low latitude environments. Specifically, the industry will have a better understanding of the impacts of the safrinha system grain loss, when subjected to high temperature, humidity, and rainfall environments.
- The industry will understand the linkage or the lack of a linkage between: in-bound grain quality and storage loss, distance to storage/market and loss, harvest management and loss.



Four Case Studies in India

The Institute commissioned four research projects in India in early 2011. An overview of the projects and some preliminary findings follow.





ADM Institute Funded Case Studies in India

- Rice in Tamil Nadu
- Maize in Rajasthan
- Black Gram in MP (Madhya Pradesh) and Maharashtra
- Red Gram (Pigeon Pea) in Maharashtra



Rice in Tamil Nadu Marketplace Literacy Communities

Empowering low-income communities through the marketplace

- Community to build literacy, skills, awareness of rights, and self-confidence needed to function in the marketplace.
 - Support roughly 100 self-help groups of 15-20 women each
 - Provide links to financial institutions
 - Provide assistance in maintaining financial records
 - Ongoing support for running enterprises
- Centrally located
 - Embedded laboratory in the rural south
 - Close to Chennai, South India
 - Network of small villages with a central town
- Partnerships:
 - Subsistence Marketplace Initiatives (UI)
 - Marketplace Literacy Project (USA)
 - Madura Micro Finance



Maize in Rajasthan
Baseline to Study the Value Chain
 An ISAP-ADM Institute, Illinois Collaboration

- Background: India is the fifth largest producer of maize; maize production has increased dramatically in the last five decades.
- Conduct a baseline survey to study the existing maize value chain in Rajasthan
 - Capture the movement of maize through various stages starting from the harvest up to processing
 - Map various intermediaries handling maize, their value addition, etc, in order to scientifically analyze losses incurred at various stages of maize handling
- 2500 farmers have pledged to work with ISAP under project SHARE for four years ensuring high quality data.
- ISAP will design a survey to be administered to respondent farmers, wholesalers, transporters, trader/aggregator, processors, stakeholders and institutions.
- The findings will form the basis for identifying the stages in the maize value chain where losses can be reduced and recommending appropriate technological interventions to minimize phl.



Black Gram in MP (Madhya Pradesh) and Maharashtra
 Mapping the production system and the supply chain and study the crop losses of Black Gram

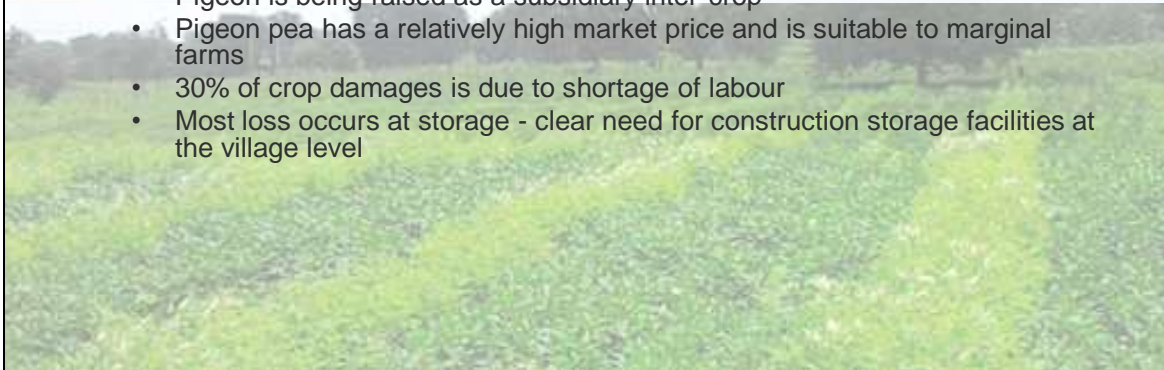
- India is the largest producer of black gram in the world, but domestic demand exceeds production.
- Maharashtra and Madhya Pradesh produce 20% and 13% of India's total black gram production respectively.
- Study will
 - Understand the causes of crop loss
 - Map technologies currently available to prevent crop loss and reasons why they are not broadly adopted
 - Identify potential for new technologies and opportunities for innovations in black gram supply chain



**Red Gram (Pigeon Pea) in Maharashtra
Farmer Surveys on Postharvest Loss in India**

A study on pigeon pea postharvest loss

- India is the world’s largest producer of pigeon pea (75% of global production)
- The study: Conducted primarily in Maharashtra during August 2011 and focused on a random sampling of villages. Two villages were selected from each taluk with five farmers from each village participating in the study for a total sample of 30 villages and 150 farmers.
- Findings:
 - Average age of a farmer is 46; education levels of farmers increased with the size of the farm
 - Pigeon is being raised as a subsidiary inter-crop
 - Pigeon pea has a relatively high market price and is suitable to marginal farms
 - 30% of crop damages is due to shortage of labour
 - Most loss occurs at storage - clear need for construction storage facilities at the village level



Farmer Surveys on Postharvest Loss in India

Findings

S.No	Stages and Factors	Loss % of yield	Loss (Kg/q)
1	Maturity stage	0.2	1.2
2	Weather impact	0.4	4
3	Harvesting	1	0.5
4	Threshing	1	1
5	Labour unavailability	0.3	1.5
6	Drying	0.1	0.025
7	Storage	10	5
8	Transportation	0.5	0.2
9	Processing	1	1
10	Total	14.5	14.425



Seed Research Projects

Early in 2011, eight research projects were funded to seed exploratory research on postharvest loss. The titles and short descriptions follow.



Department of Agricultural and Biological Engineering
Steve Eckhoff, Grace Danao and K.C. Ting

The Department of Agricultural and Biological Engineering (ABE) is currently in the process of compiling and assessing relevant literature on the severity of the postharvest losses in the target countries and on the costs of newer storage, handling technology. A wiki site was set up to allow researchers access to an online database of information and the resources that have been identified thus far are also available on the ADM Institute for the Prevention of Postharvest Loss website. During the spring 2011 semester, ABE graduate student Ning Wang worked with the Institute and with other graduate students to compile relevant data. ABE plans to distribute a white paper on their findings in fall 2011. ABE is also in the process of identifying potential partners in the targeted countries.

Department of Agricultural and Biological Engineering
Steve Eckhoff
and

Department of Electrical and Computer Engineering
Lynford Goddard

Steven Eckhoff and Lynford Goddard are working on a project titled "Distributed Wireless Monitoring of Carbon Dioxide Concentrations in Grain Bins." The goal is to develop low-cost wireless sensors that can map out the local concentration of carbon dioxide (CO₂) in large volume grain bins. Microbial respiration can thereby be monitored via changes in the CO₂ concentration over time. The sensors will be slightly larger than the size of a corn kernel and able to be mass manufactured at a relatively low cost per individual sensor. The low cost and recoverability of the sensors will enable farmers and elevator managers to **randomly distribute one hundred or more such sensors directly in the bin's** interior during bin filling for local distributed sensing.

Department of Agricultural and Consumer Economics
Pete Goldsmith

Pete Goldsmith is currently in the process of identifying potential collaborators in Brazil. Pete is planning a trip to Brazil in early June to meet with these potential collaborators to establish: research partnerships; operating processes and procedures; and the boundaries of the research activities.

Pete Goldsmith is also working on a project titled "Understanding PHL and On-Farm Storage in Mato Grosso: Liquidity, Transparency, Risk and Access to Capital." The research will study the issue of the undersupply of private on-farm and cooperative storage in developing countries. In particular, the working hypothesis is that the business, legal, and institutional environment in developing countries elevate risk and induce capital market failures associated with storage investments.

(continued)

Department of Agricultural and Consumer Economics

Rob Hornbaker

Rob Hornbaker is currently undergoing an extensive assessment project to determine the current level of preventable postharvest losses and to identify alternative scale appropriate technology for reducing postharvest loss. He is currently in the process of conducting a literature review to assess historical losses in India and will also do the same review for Brazil. The final deliverable of **Rob Hornbaker's work will include a white paper outlining the supply chain for at least one or two of the crops of interest in Brazil and India which will include initial estimates of the postharvest loss for the key stages of the supply chain.**

Department of Agricultural and Consumer Economics

Mindy Mallory

Mindy Mallory has started two white papers on the policy implications on postharvest loss in both Brazil and in India. As a part of her research, she will identify policies that either help or hinder investment in postharvest infrastructure in the two countries.

Department of Business Administration

Udatta Palekar

Udatta Palekar is currently working on two projects. The first project is developing a hands-on technique to help analyze postharvest loss at a micro-level by repurposing a successful technique from Lean manufacturing. He is creating a process map that will help identify the sources of waste and plan for an improved **future state process plan. One of Udatta's undergraduate classes finished a group project on the agricultural supply chain in the spring 2011 semester.**

Udatta Palekar is also working on modeling the agricultural supply chain. This project considers more systemic causes of postharvest loss by studying the supply chain model in a game theoretic context.

Department of Computer Science

Tarek Abdelzaher

Tarek Abdelzaher is in the process of creating a pilot project to build an automated information collection and management service that allows a provider to prompt large groups of individuals to share data via their cell phones on selected issues of concern. He is using crowd sourcing to extract accurate information by involving the general population in data collection and feedback. By using this method, he should be able to improve awareness of bottlenecks, inefficiencies, and the causes of postharvest loss.

(continued)

Department of Civil and Environmental Engineering

Ximing Cai

Ximing Cai is in the process of investigating optimal engineering solutions and infrastructure investment required to minimize postharvest loss in crop quantity and quality. His group is modeling a large scale crop supply system including harvesting, handling, storage, processing, transportation and distribution in markets. The first area currently being investigated are the risks associated with physical, environmental and social factors and an assessment of the economic benefits and costs of technical options. The second area being investigated is a project to determine the multi-echelon supply chain design to reduce postharvest loss under stochastic and dynamic/seasonal demand.



Engaging Students

The Institute seeks to engage large numbers of graduate and undergraduate students in research and project efforts. We have achieved this goal by participating in curricular activities and funding small research projects. Many of these seed projects have evolved into full scale projects funded by the Institute. Several examples are listed in this section.

- Student Involvement
- International Course Development
- BADM 380: Corporate Social Responsibility and the Multi-national Firm
- Engineering Sustainable Solutions to PHL
- Monitoring Carbon Dioxide in Storage

Student Involvement

The Institute makes every effort to involve students in its research efforts. In the first year, the following students have had an active role in researching, writing, and planning.

Rhett Farrell

Rhett Farrell is a Ph.D. student in Agricultural and Consumer Economics. His primary research interests include quality innovation in vertically linked agricultural markets and marketing systems in less developed countries. Rhett has recently worked on agricultural business development projects in Guatemala and the Dominican Republic and has professional experience in finance, accounting, and software development.

Ning Wang

Ning Wang is a second-year master's candidate in Agricultural Biological Engineering at UIUC. His hometown, Shenyang, is the biggest city of northeastern China. Previously, he has studied in the area of biological engineering including microorganism, fermentation and separation during his undergraduate education. In the future, he would like to be a leading researcher in grain storage. He is also very interested in international food trade.

Grace R. Kenney

Grace R. Kenney is a senior in Urban and Regional Planning and is completing a certificate in Global Business Culture. Grace is the child of two former military officers, and spent over 12 years of her childhood in Japan, Turkey, and China. Due to such an upbringing, she has been exposed to both urban metropolises and countryside, developing and developed countries, and wishes to use her experience in future international development issues, particularly that of environmental and agricultural planning.

Corporate Social Responsibility and the Multi-national Firm

The ADM Institute presented a lecture in Business Administration. BADM 380 Course Description: Introduces the field of international business and management. Examines the economic, political, and legal environments of international business. Analyzes differences in financial management, marketing, and management practices for firms doing business abroad. **"Corporate Social Responsibility and the Multi-national Firm: The ADM Institute" will be a course topic.**

Funding Cooperative ABE and BADM Activity

Udatta Palekar, Madhu Viswanathan, Steve Zahos

SUMMARY

The ADM Institute will provide financial support to fund certain joint efforts between teams of students in the Agricultural and Biological Engineering (ABE) senior design Industry-Linked Capstone course, ABE469, and the Supply Chain Management (SCM) program in Business Administration (BADM). The intent is to develop practical and workable solutions to the problems being addressed by the ADM Institute by engaging students in these two programs in a multidisciplinary team experience. The time horizon for the efforts described herein is the spring semester of 2012. Pending evaluation of the findings resulting from two initial phases of activities, an expanded proposal will be prepared to implement a major joint design and business case effort that will begin in fall 2012. The initial focus will be on India. Engagement with students and faculty at agricultural universities in India will be cultivated.

DISCUSSION

In the first phase it is proposed that Steve Zahos, Senior Design Capstone Coordinator in ABE, attend the 46th Annual Convention of the Indian Society of Agricultural Engineers (ISAE) February 27-29, 2012 at G. B. Pant University in Pantnagar, India, for the purpose of making initial contacts with potential collaborators on the senior design project work. Some support for his expenses will be available from ABE469 education enhancement funds.

The second exploratory phase will be the sending of a team of students from the Supply Chain Management Program and ABE to India for a 10-day trip over spring break in March. The team will be accompanied by Professor Palekar, Associate Professor and Director of the SCM program, College of Business. There will be two students from ABE and a maximum of 8 students from the SCM program. One ABE student will be enrolled in the senior design course in the spring semester 2012 and one will be enrolling in the precursor course ABE430 in Fall 2012 and senior design in spring 2013. THE SCM students will range from sophomores to seniors. The cost for each participant is expected to be approximately \$3,500 plus incidentals. A \$500 Wertz scholarship is available for each student. In addition, the ABE students will have support through IPENG and the College of ACES. The exact amount of this support is not known yet. A very limited amount of partial support for the SCM students may also be available through SCM program funds. We would like to limit the out-of-pocket cost to each student to be around \$1,000 but no more than \$1500.

This exploratory trip will provide initial first-hand impressions, problem definitions and ideas for addressing the needs in the post-harvest supply chain. The initial trip will also help us devise a more concrete plan for future practicum/senior design activities in conjunction with the ADM Institute. It is believed that plan will facilitate the process for finding solutions with continuity of participants and best leverage the assets being supported.

Engineering Sustainable Solutions to Postharvest Loss

An interdisciplinary team led by Civil and Environmental Engineering Associate Professor Ximing Cai and comprised of students from Construction Management, Transportation, Construction Materials, and Hydrology and Hydraulic Engineering recently completed a literature review summarizing the concept of PHL, identifying current techniques to reduce PHL, and highlighting important gaps in existing PHL research.

The concept of PHL is summarized by the engineering team in terms of decrease in quantity by weight as well as the reduction in product quality from harvest to consumption. The team found that existing literature tends to emphasize quantitative loss in the context of developing countries; while loss due to product quality, which affects nutritive/caloric composition, acceptability to the consumer, and the edibility of a product, tends to be more prevalent in developed countries.

Stages of the supply chain identified in existing research on PHL indicate the potential for staggering levels of loss. The following table outlines recently published information on loss estimates for the Asia Pacific Region.

Internal and external factors leading to PHL are highlighted in the literature review. Broad areas encompassing internal factors are included in Table 1. Specific internal factors include handling at harvest; drying and transport; storage; primary processing (cleaning, classification, de-hulling, pounding, grinding, packaging, soaking, winnowing, drying, sieving, milling); secondary processing (mixing, cooking, frying, molding, cutting, extrusion); product evaluation and quality control; packaging; marketing and distribution; and consumer and post-consumer waste and disposal of food.

External factors identified in the literature include environmental factors such as climatic conditions (wind, humidity, rainfall and temperature) that contribute to loss by in-field falling as well as damage from mold and fungus, pests such as insects and rodents which contribute not only to quantity loss but also to quality loss through contamination. Other external factors include consumer intolerance of substandard foods, and socio-economic factors such as urbanization and increasing household affluence, which leads to a reduction of farm labor force and an increase in consumption of perishable commodities such as meat and produce by urban consumers. (continued)

Table 1
Percentage loss in post-harvest supply chain, Asia Pacific Region

Harvesting	5-8 percent
Storing operation	15-20 percent
Storage	5-10 percent
Transport	10-12 percent
<i>i.e. a theoretical total</i>	35-50 percent

(Source: APO & FAO 2006)

Engineering Sustainable Solutions to Postharvest Loss (cont'd)

High impact measures to reduce PHL are summarized in the literature review with a focus on those most important to developing countries. Examples of these measures include considerably greater investment in formal markets to improve infrastructure and the capacity of agro-food supply chains, and a shift to the use of indigenous crops that are more suited to the local climate.

Implementing sustainable solutions through the entire food supply chain, as highlighted in the research, is crucial to the realization of a meaningful reduction in PHL. This will require large-scale investment in agriculture infrastructure, technology skills and knowledge, storage, transport, and distribution. A consideration of socio-economic factors, such as changes in demand in developing countries from a market based on starchy foods to one that depends more on meat and perishable produce, is also important to the sustainable reduction of PHL.

An integrated, sustainable, and resilient supply chain emerged as a critical missing component in the overall reduction of PHL over the course of the literature review process. Though biological and environmental factors, which contribute to PHL, are well understood and several technologies have been developed to reduce loss, the team discovered that other factors have inhibited progress. As current research indicates, inadequate marketing systems and transportation facilities, governmental regulation and legislation, unavailability of tools and equipment, lack of information, and poor maintenance of facilities and warehouses have

hindered attempts to apply available knowledge and technology in the prevention of PHL.

(continued)

*Civil and Environmental
Engineering Literature Review
Team*

*Pictured L-R: Yun Bai, Moatassem
Abdullah, and Michelle Miro.*

*Not pictured: John Michel, Ahmed
Abdelmohsen, Ximing Cai*



Engineering Sustainable Solutions to Postharvest Loss (cont'd)

Areas in which further research is needed include the benefits of pre-cooling technology and its effect on PHL; how improvements to the supply chain, such as on-farm technologies, central storage, vehicles and transport in Brazil, Russia, India and China would affect PHL; and additional comprehensive studies on PHL loss for a single commodity supply chain or for the supply chain in a single country.

Important research areas and related questions highlighted by the team include:

- *Strategic supply chain design*: How do we increase the reliability of supply chain design considering probabilistic characteristics of external factors such as adverse weather conditions, storage/processing facility failures, insect pests, and transportation infrastructure failure?
- *Harvest*: How can farmers better predict optimal harvest time?
- *Handling*: How can contamination and damage be reduced in processing?
- *Storage*: How can storage structures better withstand negative environmental effects, and how can bio-deterioration in storage be reduced?
- *Transportation*: What is the optimum transportation method and network to reduce post-harvest loss while minimizing cost of technologies?

Monitoring Carbon Dioxide in Storage

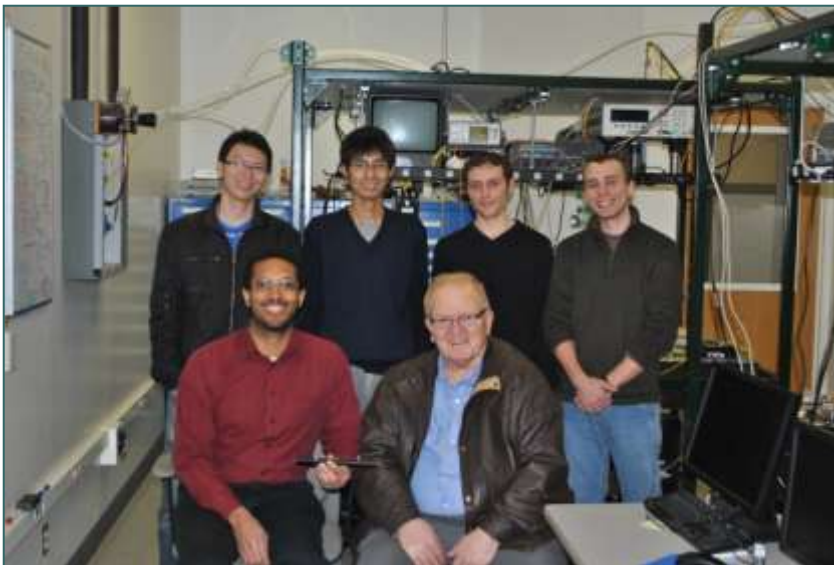
A team of graduate students working under the direction of Steven Eckhoff, Professor of Agricultural and Biological Engineering, and Lynford Goddard, Assistant Professor of Electrical and Computer Engineering, are developing a low-cost laser-powered fiber optic sensor designed to measure levels of carbon dioxide (CO₂) in grain storage bins.

The presence of elevated CO₂ levels in grain storage facilities is commonly the result of respiration by insects and microbial life forms such as mold and fungus, which can cause significant loss in grain weight and quality. The presence of fungus can also lead to the generation of mycotoxins, toxic metabolites which cause serious health problems in consumers.

The common approach to monitoring grain in storage for the presence of insects and microbial life is the use of thermal cables in order to detect increases in temperature, which results from insect and microbial respiration. However, this method is limited by the low thermal diffusivity of bulk grain.

Temperature measurement alone is not sufficient for effectively detecting insect and microbe respiration due to infestation, which is a major problem in tropical regions. Recent research has found that monitoring the head space of a bin with a CO₂ sensor can lead to earlier detection of microbial or insect degradation of the grain. However, the system only gives an average concentration that is complicated by convective mass transfer in the head space. Ideally, a sensor system would give a spatial indication of where deterioration is occurring.

(continued)



*Back Row L-R:
Haibo Huang,
Renjie Zhou, Ben
Griffin, and Steve
McKeown.*

*Front Row L-R:
Lynford Goddard,
Steven Eckhoff.*

*Not pictured:
Bussaba
Amnueypornsakul.*

Monitoring Carbon Dioxide in Storage (cont'd)

In order to determine the accuracy of imbedded CO₂ sensors relative to thermal sensors, the engineering team conducted tests with commercially available battery operated wireless CO₂ sensors in a mock storage bin of 0.3 meters in diameter and 3.4 meters in height. The storage bin was filled with eight bushels of corn (448 pounds), and sensors were placed in the center of the bin at depths of 1.2 and 2.4 meters as well as at the bottom and the top of the bin.

A known concentration of CO₂ was injected into the center of the bin at a height of 0.6 meters, and a thermal-resistance was placed at the same location to generate heat. CO₂ readings were collected wirelessly, and thermal couples were installed to monitor temperature changes in the grain storage bin. The results of this study confirmed that CO₂ measurements were more effective than thermal sensing in indirectly detecting spoilage.

While wireless CO₂ monitoring systems are commercially available, the high cost of these devices prohibits smallholder and marginal farmers from investing in such technology. In addition, the transmission range of currently available CO₂ monitoring systems installed inside the grain bin may restrict their usage to surface or near-surface measurements.

The experiment outlined will be repeated with a laser-based fiber optic CO₂ sensor developed by the Illinois engineering team to determine how accurately it measures CO₂ levels in comparison with commercially available devices.

This new sensor, which is nine inches in length with a diameter of nine millimeters, is constructed with two internal lenses and a fiber cable adapter on each end. The sensor is pulled to various locations inside the grain bin using the fiber tether, providing a spatial indication of where deterioration is occurring. This sensor is designed to sweep through the light absorption range of CO₂ in order to more accurately detect concentration and diffusion.

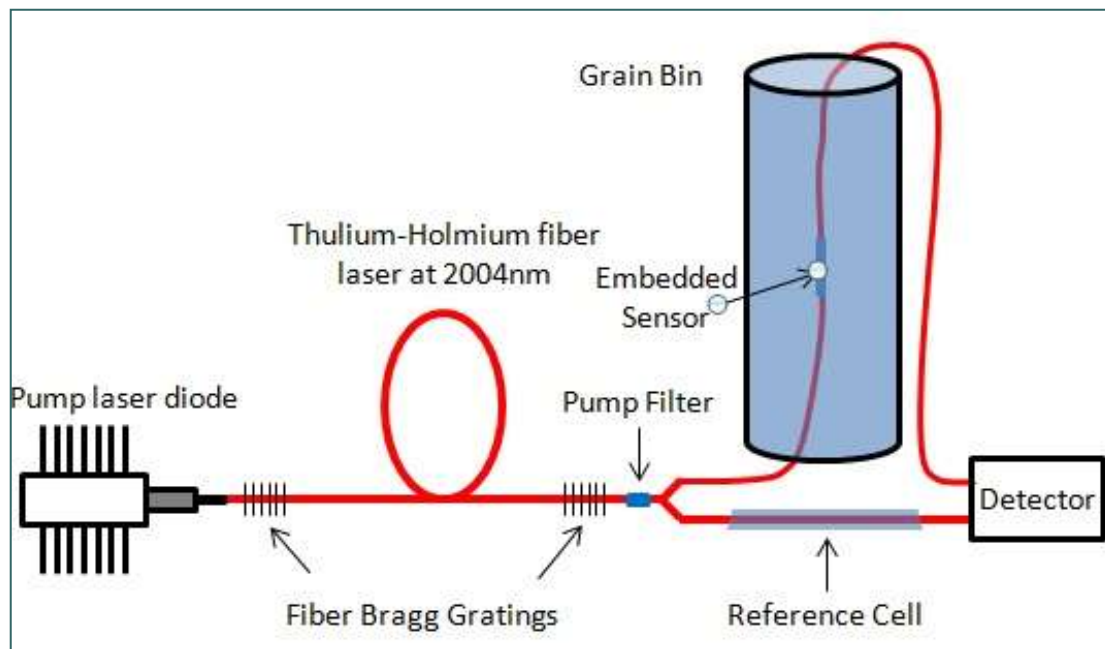
(continued)

Monitoring Carbon Dioxide in Storage (cont'd)

A separate reference cell filled with CO₂ is placed outside the bin and allows the operator to determine when the laser reaches an intensity level at which light will be absorbed by CO₂.

The research team's objective is to develop low-cost embedded sensors that can map out regions of insect or microbial activity inside grain bins by quantifying the local concentration of CO₂. It will be possible to collocate these CO₂ sensors with temperature sensors in most applications. Microbial and insect respiration can be monitored via changes in CO₂ concentration over time and location.

Expected outcomes from development of the CO₂ sensor include providing a lower cost option for smallholder and marginal farmers, reducing PHL due to insect and microbe infestation, and reducing health risk to consumers from mycotoxins produced by fungus.



Graphic of the device created by the team of graduate students working under the direction of Steven Eckhoff, Professor of Agricultural and Biological Engineering, and Lynford Goddard, Assistant Professor of Electrical and Computer Engineering.

Outreach

The ADM Institute is strategic in advancing its mission, vision, and goals in an effort to reduce postharvest loss. Participating in conferences and symposiums, producing and publishing news articles and research papers, and maintaining a robust website are some of the ways in which the messages, brand and image of the Institute are promoted. Examples of these types of outreach activities are included in this section with selected news media announcements about the Institute.

- Conferences and Symposiums
- Press
- Publications
- PHL in the News
- Periodic Reports
- Website





CONFERENCES AND SYMPOSIUMS

2011

- *Innovative Solutions for Reducing Post Harvest Losses*, World Bank invited presentation, Washington, DC
- *Opportunities for Innovation in Indian Agriculture Sector*, Plenary address and symposium co-sponsor with Indian Consul in Chicago

2012

- Keynote address and sponsor of symposium session on postharvest loss at the Indian Society of Agricultural Engineering Annual Convention and International Symposium, Pantnager, India
- Plenary address at the 22nd Annual World Forum of the International Food and Agribusiness Management Association, Shanghai, China
- Keynote address; Annual meeting of the Brazilian Agricultural Engineering Society



News Articles Search News GO

Postharvest Loss Institute focusing on cutting waste

By TIM ALEXANDER
Illinois Correspondent

URBANA, Ill. — The University of Illinois' new ADM (Archer Daniels Midland Co.) Institute for the Prevention of Postharvest Loss, established with a \$10 million grant from the company, will focus its initial efforts towards reducing world hunger in India and Brazil, according to Steven Sonka, Uol professor of agricultural management.

"(ADM's) gift is a very large and generous gift, and the problem is enormous," said Sonka, reflecting on the challenge the fledgling enterprise faces in identifying and reducing causes of postharvest losses that measure millions of metric tons of grains and oilseeds each year to pests, disease, mishandling and other factors.

With global population expected to reach 9.2 billion by 2050, preserving more of the Earth's bounty of crops is fundamental to feeding the world, according to Patricia A. Woertz, ADM chair, CEO and president.

"This institute will help farmers around the world through training, tools and technologies that can help eliminate pests and disease, enable more efficient grain storage and handling, prevent spoilage and improve crop quality overall," she stated.

The initiative, announced Feb. 20, is funded through the "Strong Roots" branch of the company's "ADM Cares" program, a corporate social investment initiative which examines problems and solutions pertaining to global agriculture.

"ADM leadership has publicly noted that postharvest waste is at high levels in some crops and in some countries. If we can reduce the waste, it will provide more food," said Sonka.

Institute members will be added in the coming weeks, though their initial agenda is already defined.

"In particular, this institute will focus on staple crops such as corn, soybeans and wheat. We will be working with small-holder agriculture, not giant agricultural combines. We'll be looking in developing countries, particularly where a lot of harvesting is done by hand," Sonka explained.

"We have selected India and Brazil as our first targets because of their importance in terms of having large, small-holder agriculture segments and also because we have existing ties we will draw from."

FarmWorld

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The next few months will be devoted to studying past data and crafting a more well-defined mission statement before the Institute begins fieldwork as early as in the fall, Sonka said. Foremost experts in their fields employed by several departments of the university will spearhead the research.

"We have faculty from our College of ACES (Agricultural, Consumer and Environmental Sciences), our College of Business and College of Engineering (involved)," Sonka said.

"This is a global problem, but the characteristics are very local. Postharvest waste depends on socioeconomics but also climatic conditions. Our goal is to contribute to the more rapid identification and implementation of approaches that will help to reduce postharvest loss. Methods and processes are at the heart of this, and we hope to contribute to developing improved and appropriate methods and processes."

K.C. Ting, head of Uol's Department of Agricultural and Biological Engineering for the College of ACES, said reducing crop waste in developing countries relies on site-specific approaches.

"We need to find the appropriate technologies for developing countries. Many of our solutions to these problems are technology- and facility-sensitive, but in developing countries you have to provide solutions that match the local environment," according to Ting. "The real challenge is to address and solve their problems in a way, and at a cost, that can be delivered to those producers within their infrastructure."

ADM, U of Ill. start new food-waste research

By DAVID MERCER, Associated Press
Wed Jan 19, 5:58 pm ET

URBANA, Ill. — Farmers in Argentina have found that simply using jumbo plastic bags can help protect their harvested corn from the elements before it's sold and heads for processing.

Measures like that — which could cut down on the millions of pounds of grain that spoil or otherwise go to waste each year — will be the focus of a new effort at the University of Illinois to find ways to help feed the developing world.

Archer Daniels Midland CEO Patricia Woertz and university officials announced plans Wednesday for the new ADM Institute for the Prevention of Postharvest Loss at the university's campus in Urbana. ADM plans to spend \$10 million over the next five years on the effort.

"There are existing technologies today that we know are not being implemented in developing countries," University Vice Chancellor Steve Sonka, who will lead the institute, said in an interview. "We need to know why."

The United Nations estimates that 10 to 15 percent or perhaps more of the world's grain goes to waste each year. At the same time, roughly a billion people around the world don't have enough to eat — ADM cited University of Illinois research that indicates the wheat and rice lost around the world in 2007 could have fed about 380 million people.

"Clearly, preserving what is already grown is fundamental to feeding the world, and to making the most of the land, water, energy and other inputs already used to grow crops," said Woertz.

ADM, based 50 miles southwest of the university in Decatur, is one of the largest processors of corn, soybeans and other grains in the world.

The new institute will start work by trying to find and develop easy-to-use technologies like the corn bags in Argentina, studying why they're not being used in the developing world and figuring out to put them to work there, Sonka said.

"What's being done and what are the impediments?" Sonka said. "Just assessing the current situation in a rigorous fashion."

ADM, U of Ill. start new food-waste research (continued)

Then he anticipates using the money to put researchers to work and getting the technology to the farmers and others who can put it to use. He isn't sure how many people he will need.

The institute also plans to work with similar efforts at schools like the University of California-Davis, where research focuses on wasted fruits and vegetables, Sonka said. He also hopes to work with government agencies and other groups around the world.

While ADM's commitment to the institute lasts five years — at \$2 million a year — Sonka hopes the work attracts attention and funding from governments and other companies.

"We believe this is a topic that has legs," he said.

ADM funds new postharvest institute

INSIDE ILLINOIS, Feb. 17, 2011

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Archer Daniels Midland Co. announced a \$10 million grant to establish the ADM Institute for the Prevention of Postharvest Loss at the UI. The global institute will work with farmers in the developing world to help preserve millions of metric tons of grains and oilseeds lost each year to pests, disease, mishandling and other factors.

"By the year 2050, global population is expected to reach 9.2 billion, and the demand for agricultural products is expected to double," said Patricia A. Woertz, ADM chairman, CEO and president. "Clearly, preserving what is already grown is fundamental to feeding the world. This institute will help farmers around the world through training, tools and technologies that can help eliminate pests and disease, enable more efficient grain storage and handling, prevent spoilage, and improve crop quality overall."

Steve Sonka, vice chancellor for public engagement, will serve as the global institute's faculty director.

"ADM's widely recognized expertise in crop storage, transportation and handling will no doubt prove valuable to our global institute as we work to advance the real-world applicability of promising research findings," Sonka said.

Sonka will work with researchers in the [College of Agricultural, Consumer and Environmental Sciences](#) and in other colleges to develop research projects to solve postharvest problems.

The [department of agricultural and biological engineering](#) is one of the units in ACES and the [College of Engineering](#) that will work closely with the new institute. K.C. Ting, the head of the department, said: "We need to find the appropriate technologies for developing countries. Many of our solutions to these problems are technology and facility intensive, but in developing countries you have to provide solutions that match the local environment. The real challenge is to address and solve their problems in a way, and at a cost, that can be delivered to those producers within their infrastructure."

The costs of feeding the world's hungry will be addressed by researchers in the department of agricultural and consumer economics in ACES.

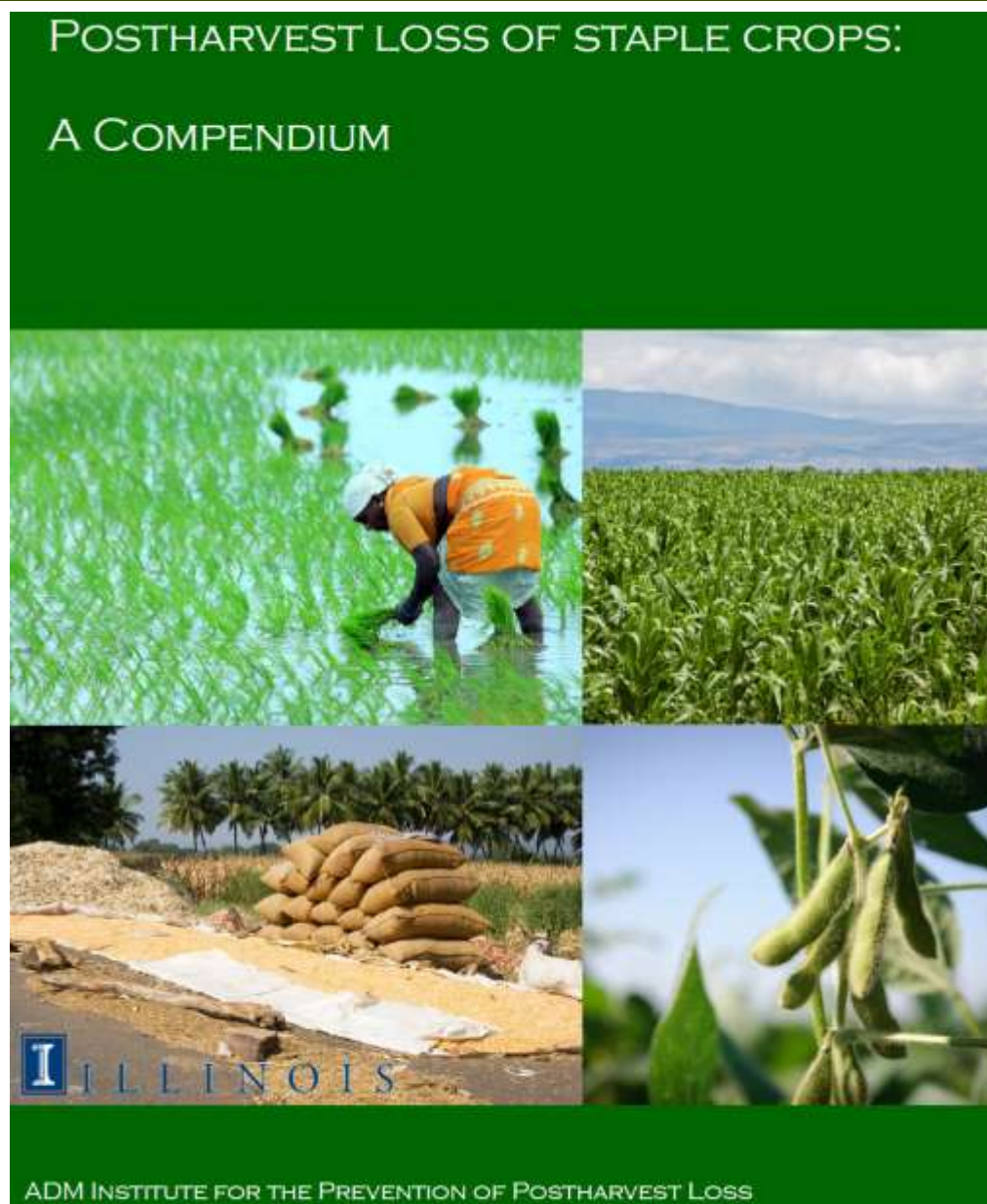
"Assessing the economic costs of quality and quantity losses along the relevant supply chains will be essential in developing low-cost sustainable solutions for improving handling, processing and storage," said Paul Ellinger, a professor and the head of agricultural and consumer economics. "Economic feasibility assessment of viable solutions combined with training materials for producers and handlers will also be essential to maintain sustainable outcomes."

Funding for the new institute will be provided by ADM Cares, a corporate social-investment program.

"Scientific Animations Without Borders: An International Collaborative Approach for Building Scientific Educational Materials for Use on Cell Phones and the Internet in Developing Nations" *The International Journal of Science in Society*, Volume 2, 2011

Julia Bello-Bravo, University of Illinois at Urbana Champaign, Illinois, USA; Francisco Seufferheld, University of Illinois at Urbana Champaign, Illinois, USA; Laura D. Steele, University of Illinois at Urbana Champaign, Illinois, USA; Tolulope A. Agunbiade, University of Illinois at Urbana Champaign, Illinois, USA; Daniel Guillot, Universidad Nacional de Cuyo, Mendoza, Argentina; German Cutz, University of Connecticut, Connecticut, USA; Barry R. Pittendrigh, University of Illinois at Urbana Champaign, Illinois, USA.

The Institute will publish a Compendium Report in the coming months. The report is in the editing phase.



Beginning in July 2011, the Institute has produced and disseminated an electronic news update called *Postharvest in the News*. "In the News" is published weekly and contains recent PHL information from newspapers, blogs, websites and other media. It is published online and disseminated to a broad audience via email. This is the most recent "In the News".

ADM Institute for the Prevention of Postharvest Loss
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

PHL in the News
February 28, 2012 Update

The following items have appeared recently in newspapers, blogs, or websites and other media regarding PHL and might be of interest to affiliates of the ADM Institute for the Prevention of Postharvest Loss.

News from the ADM Institute

- The February 2012 edition of the Periodic Report for the ADM Institute for the Prevention of Postharvest Loss is now [available online](#).

Africa

- Hermetic bags from the [Farbus Integrated Cowpea Study \(FICS\)](#) are found to save crop in unexpected ways, as they are useful in preventing the growth and feeding habits of weevils in cowpea storage, particularly through depleting the levels of oxygen in the bags. The program is expected to be adopted by 3.4 million households in West and Central Africa, which will save half a billion dollars a year in saved grain overall.
- Although benefiting greatly from the [Millennium Challenge Account Compact \(MCA\)](#), a large amount of loan money was returned unused to the lending bank, and many farmer loans were not repaid in time. Major inhibitors to the success of the program targeting Ghanaian farmers were "willful negligence," bad weather conditions, pest infestation, and lack of value chain activities. Food processing equipment and information and communication technology and infrastructure have been identified as key elements to the success of future programs.

Middle East

- The Arab Authority for Agricultural Investment and Development (AAID) is planning a [storage system for three to six months of Gulf region grain reserves](#). The location will most likely be in the UAE because it is close to the port of Fujairah in the Gulf of Oman. This project comes in conjunction with the start of an agricultural land investment company to buy land in the Middle East and throughout Central Asia. Egypt is being heavily considered for more investment in wheat and oilseed production as well.

North America

- Both the [United States](#) and [Canada](#) have experienced unsatisfying harvests due to weather and transportation issues, and have, as a result, one of the smallest and lowest-grade crops on record. In the US, warmer weather limited access to on-farm storage bins and slowed down crop delivery.
- [Kansas State University](#) is partnering with the Australian Plant Biosecurity Cooperative Research Centre to "study emerging plant diseases and insect pests that threaten American and Australian agricultural systems and develop new strategies and technologies to defend against them." Grain storage solutions will also be a focus for the collaborators' research.

Europe

- Russia is planning to create a ["Far East grain corridor"](#) to compete with US and Australian grain production as part of its goal to become the world's third largest wheat shipper. The Russian Grain Union is hosting a conference to "attract interest to the agro-industrial sector of Siberia and Far East, modernization of storage, processing and transshipment infrastructure."

Conferences and Symposia

- 13-15 March 2012 - Gujarat, India
[Unlocking Value in Water, Energy, and Agriculture Nexus](#)
- 1-4 April 2012 - Wageningen, The Netherlands
[Agriculture in an urbanized society](#)
- 23-25 April 2012 - New York City, USA
[Global Agriculture 2012](#)
- 3-6 May 2012 - Osaka, Japan
[Asian Conference on Sustainable Energy and the Environment](#)
- 15-17 May 2012 - Tel Aviv, Israel
[Agriculture in an urbanized society](#)
- 29 October - 1 November 2012 - Punta del Este, Uruguay
[Global Conference on Agricultural Research for Development 2012](#)
- 23-28 November 2012 - Stellenbosch, South Africa
[The CIGR 10th Technical Symposium and the 2nd 10th Conference on Postharvest Technology & Quality Management \(PDF\)](#)

Reports

IRRI has added a [new section to its website](#) including information on how to add value to rice production through targeting PHL. Reports and projects targeting PHL are highlighted as well.

Jobs

Carolina Corporation is calling for a [Post Harvest Policy Advisor](#) located in Rwanda full-time to work on the current USAID Post-Harvest Handling and Storage (PHHS) Project.

Mercor Corp is calling for an [Ag & Market Environment Program Manager](#) for its West program.

The ADM Institute for the Prevention of Postharvest Loss at the University of Illinois is seeking applications for [two postdoc research associate positions](#) of one year to collaborate with scientists in India and Brazil on postharvest supply chain research.

Slides

Slides from a recent presentation by USDA representative Floyd Dowell on ["Storage Solutions to Improve Food Security for Small Farmers"](#) were recently published online. The presentation focused on PHL and ways to mitigate the causes of loss.

The Institute has published three Periodic Reports available at <http://postharvestinstitute.illinois.edu/reports.html>. Below is the first page of the February 2012 issue.

THE ADM INSTITUTE
FOR THE
PREVENTION OF
POSTHARVEST LOSS

Periodic Report

Periodic Report

February 2012

About this issue:

*The ADM Institute at the University of Illinois in partnership with InnovoSoy has released projections on post-harvest loss of rice in India in 2030.

*University of Illinois engineers study PHL to identify gaps in existing PHL research and ways to reduce PHL.

*Elevated levels of carbon dioxide (CO²) in storage bins contribute to PHL. A team of UI engineers are developing a low-cost laser-powered fiber optic sensor designed to measure levels of CO² in grain storage bins.

Inside this issue:

Postharvest Loss in 3D 1

Engineering Sustainable Solutions to Post-harvest Loss 3

Monitoring Carbon Monoxide in Storage 4

Postharvest Loss in 3D

The ADM Institute for the Prevention of Post-harvest Loss has commissioned InnovoSoy to combine animation and visualization to document and visualize trends in PHL.



InnovoSoy: Cutting Edge, Powerful Data Visualization

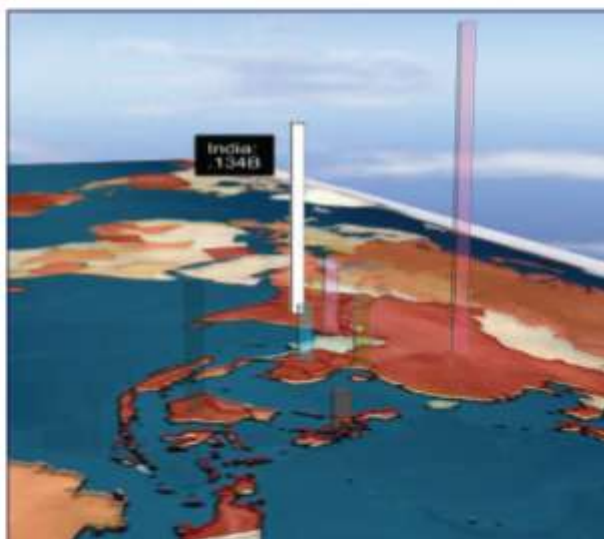
InnovoSoy uses innovative technology to display data three-dimensionally. Using economic and visualization tools, the company's proprietary software (Global 3D Loss) analyzes data and forecasts trends in PHL. The resulting visual aid rivals video game graphics while presenting content rich, analytic and predictive data.

InnovoSoy's technology is designed to explore and examine the relationships between production and consumption worldwide, income elasticities for different commodities cross regions, growth trends and net changes in production and consumption, and more.

Global 3D Loss and Postharvest Loss

This technology has great implications for PHL. Looking at future trends for rice in India, for example, we can anticipate the future dynamics of PHL.

In 2009, India was the second largest producer of rice in the world (see image below). Rice consumption is culturally very important to many segments of the Indian populace.



India was the second leading producer of rice in 2009. (source: InnovoSoy)

Website

The ADM Institute for the Prevention of Postharvest Loss website is informational, robust and current. The website is updated weekly with newsletters, current events and research developments. Following are screenshots of sections of the website.

ADM Institute for the Prevention of Postharvest Loss
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

HOME | **ABOUT** | ISSUES | RESEARCH | RESOURCES | OUTREACH |

About

Structure of Institute The ADM Institute for the Prevention of Postharvest Loss is located at the University of Illinois at Urbana-Champaign. Dr. Steven Sonka serves as Director of the Institute, and oversees the research, education and outreach activities of the Institute.

Steering Committee The Steering Committee provides guidance and oversight of the ADM Institute for Prevention of Postharvest Loss. The Board is comprised of one ADM member appointed by ADM and five University of Illinois members.

External Advisory Board An External Advisory Board provides strategic guidance and assistance to the Director and Governing Board. The Board meets annually, and is comprised of members representing various academic, commercial, governmental and non-governmental institutions with strong interests and experience in post harvest loss issues.

Periodic Reports The ADM Institute for the Prevention of Postharvest Loss plans to post Periodic Reports to provide an update on the activities of the Institute. [Visit the Reports page for recent Periodic Reports.](#)

PRESS RELEASE

ADM Institute for the Prevention of Postharvest Loss | University of Illinois at Urbana-Champaign | 807 S. Wright Street, Champaign, IL 61820 | 217-244-1113 | postharvestinstitute@uiowa.edu | HOME | ABOUT | ISSUES | RESEARCH | RESOURCES | OUTREACH |



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HOME | ABOUT | **ISSUES** | RESEARCH | RESOURCES | OUTREACH

Issues

The World Bank issued an updated poverty brief (August 2009) which estimated that in 2004 there were 1.4 billion people living below the international poverty line – defined as US\$1.25 per day. At these poverty levels, the reality for addressing hunger will focus on staple crops that provide key energy and protein requirements. Wheat, corn and rice are staple crops that provide 60% of the world's food energy intake, according to FAO. Oilseeds are also an important source of energy in the human diet. The focus of research efforts internationally on postharvest loss prevention for corn, wheat and oilseeds are based on two key elements:

1. Impacting broader societal issues requires a focus on staple crops that serve as the primary nutritional sources to meet energy and protein requirements for low income populations; and
2. Postharvest loss in developing countries is much higher than in the US; investment in reducing crop losses internationally would have a much greater impact on efforts to reduce hunger than investment in reducing domestic losses.

Given the large quantity of these staple crops produced globally, reductions in postharvest loss can significantly increase available supplies. The Institute will leverage this prior research while assessing current post-harvest loss challenges in Brazil and India, and also explore opportunities for utilizing advances in technology. Faculty at Illinois will bring their knowledge of these crops and relevant supply chains to the Center and expand research efforts through key partnerships with both U.S. and international universities, NGOs and government. ADM has extensive expertise in these crops, and leveraging existing and developing partnerships in India and Brazil will allow for more timely advances in assessments and research efforts.



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HOME | ABOUT | ISSUES | **RESEARCH** | RESOURCES | OUTREACH

Research

Current Research Updates

Department of Agricultural and Biological Engineering Steve Eckhoff, Grace Danao and K.C. Ting

The Department of Agricultural and Biological Engineering (ABE) is currently in the process of compiling and assessing relevant literature on the severity of the postharvest losses in the target countries and on the costs of newer storage, handling technology. A wiki site was set up to allow researchers access to an online database of information and the resources that have been identified thus far are also available on the ADM Institute for the Prevention of Postharvest Loss website. During the spring 2011 semester, ABE graduate student Ning Wang worked with the Institute and with other graduate students to compile relevant data. ABE plans to distribute a white paper on their findings in fall 2011. ABE is also in the process of identifying potential partners in the targeted countries.

Department of Agricultural and Biological Engineering Steve Eckhoff

and Department of Electrical and Computer Engineering Lynford Goddard

Steven Eckhoff and Lynford Goddard are working on a project titled "Distributed Wireless Monitoring of Carbon Dioxide Concentrations in Grain Bins." The goal is to develop low-cost wireless sensors that can map out the local concentration of carbon dioxide (CO2) in large volume grain bins. Microbial respiration can thereby be monitored via changes in the CO2 concentration over time. The sensors will be slightly larger than the size of a corn kernel and able to be mass manufactured at a relatively low cost per individual sensor. The low cost and recoverability of the sensors will enable farmers and elevator manager to randomly distribute a hundred or more such sensors directly in the bin's interior during bin filling for local distributed sensing.





ADM Institute for the Prevention of Postharvest Loss

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN



HOME | ABOUT | ISSUES | RESEARCH | **RESOURCES** | OUTREACH |

Resources

Below are links to categories within the master list of all postharvest loss resource material collected. More information coming soon.

- [Literature](#)
- [Databases](#)
- [Tools](#)
- [Projects](#)
- [Videos](#)
- [Events](#)



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HOME | ABOUT | ISSUES | RESEARCH | **RESOURCES** | OUTREACH |



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HOME | ABOUT | ISSUES | RESEARCH | **RESOURCES** | **OUTREACH** |

Outreach

Presentations

"Opportunities for Innovation in Indian Agriculture Sector"
October 4, 2011. Presentation given at in Chicago, IL, by Steve Sonka (PPT)

This event highlighted recent and potential innovations in production practices, efficient use of water, farm financing, minimizing post harvest loss, and Indian food systems. Speakers and panelists included representatives from various agencies of the Government of India, researchers and faculty from the University of Illinois and Michigan State University, and corporate representatives from major agricultural and technology firms in the US and India.

"Innovative Solutions for Reducing Post Harvest Losses"
September 20, 2011. Presented at the World Bank by Pradeep Khanna (PPT)

This presentation was given at the conference titled "Improving Food Security by Reducing Post-Harvest Losses" held at the World Bank. The conference was hosted by The Partnership to Cut Hunger and Poverty in Africa and Agriculture and Rural Development Department of the World Bank, in collaboration with Abt Associates, Inc. and GrainPro.

Article Related to the ADM Institute

"ADM Employees Donate 133,930 Pounds of Food to Help Feed Families Around the World." Marketwatch.com. November 8, 2011.



The ADM Institute held the first External Advisory Board Meeting on February 6, 2012. This section lists the members and agenda for the meeting.

External Advisory Board Members

Chair	Robert Easter	Former Chancellor, University of Illinois
	Usha Barwale-Zehr	Chief Technology Officer, Mahyco Seeds
	Carlos Campabadal	Grain Industry Consultant, Asociación Americana Soys-IM
	Ashok Gulati	Chairman, Commission for Agricultural Costs and Prices, Ministry of Agriculture, Government of India
	Hans Joehr	Corporate Head of Agriculture, Nestle
	Dirk Maier	Professor and Head, Department of Grain Science and Industry, Kansas State University
	Domingo Lastra	Vice President, Business Growth, Archer Daniels Midland Company
	Kent Miller	Director, Global Strategic Quality, John Deere
	Steve Mills	Sr. Executive Vice President, Archer Daniels Midland Company
	Arlene Mitchell	Deputy Director, Agricultural Development/Access and Market Systems, Bill & Melinda Gates Foundation
	Daniel Queiroz	Department of Agricultural Engineering, Universidade Federal de Viçosa

ADM Institute for the Prevention of Postharvest Loss
External Advisory Board Meeting
(February 6 - 7, 2012 ~ Union League Club, Chicago Illinois)

Agenda

Monday, February 6th Union League Room on the 5th floor (Also referred to as the boardroom)

10:00 Convene/Introductions

10:30 Rationale for PHL Institute; ADM perspective

11:00 What do we know about PHL today?

12:00 Group lunch in Union League Club

1:00 Group discussion of post harvest loss issues
Board members share thoughts first
Discussion among entire group

2:00 Overview of ADM Institute progress to date
*In this session we will have a mix of presentations and discussion until 4:15
(We will take a 20 minute break around 3:00 pm)

Organization development activities conducted in 2011

Case study efforts in India

Mato Grosso soybeans and Aprosoja (Goldsmith)

Presentation of seven research projects recently funded

*For each project, we will have a short video with a project Principal Investigator, followed by discussion led by a Steering Committee member

Additional activities/initiatives

Undergrad practicum projects in India

Brainstorming session with similar US Land-Grants, fall 2012

Community of Practice effort in Africa

Agricultural Innovation in India

Chicago conference, October 2011

Delhi conference, fall 2012

Conference presentations

Indian Society of Agricultural Engineers, Feb 2012

Brazilian Society of Agricultural Engineers, July 2012

Int'l Food and Agribusiness Management Association, June 2012

Other topics to be identified

4:15 Discussion of selected overarching concepts

Resource scarcity

World Economic Forum's New Vision for Agriculture

Innovation ecosystems

5:00 End of day

Dinner at restaurant outside of Union League Club, within walking distance of ULC

ADM Institute for the Prevention of Postharvest Loss
External Advisory Board Meeting
(February 6 - 7, 2012 ~ Union League Club, Chicago Illinois)

Agenda—Day Two

Tuesday, February 7th Union League Room on the 5th floor

- 8:00 Key questions for the day
 Crafting the ADM Institute thought paper
 Collaborative opportunities that should be pursued in Months 14-36
- 8:15 The ADM Institute thought paper;
 Given the overarching concepts and what we know about post harvest loss, what are the key points that should be included in **section 3** of the paper, **Implications for the ADM Institute for the Prevention of Postharvest Loss?**
- 8:30 Breakout sessions
- 9:30 Larger group discussion of ideas
- 10:15 Break
- 10:35 Collaborative opportunities that should be pursued in Months 14 – 36
 High priority topics of opportunity across key dimensions
 Commodity type
 Geography
 Prospects for collaboration
- 11:30 Closing thoughts
- 12:00 Lunch in Union League Club