

Grain Quality Newsletter

News and Highlights from NC-213: Marketing and Delivery of Quality Grains and BioProcess Coproducts.

Volume 29:3

NC-213 The U.S. Quality Grains Research Consortium

Calendar items of interest ...

Upcoming deadlines and events

- Andersons Research Grant Program—Regular Competition 2009: Six proposals were received. Awarded proposals will soon be announced.
- NC-213 Annual Meeting 2010: Our Annual Meeting will take place in Kansas City, Missouri, at the Embassy Suites KCI. The dates are February 3–5, 2010.

International events

- November 3–5, 2009. "Soya & Oilseed Summit 2009." The Roosevelt Hotel. New Orleans, LA, USA. Contact: Soyatech, LLC. Tel: +1 (202) 244 9544, E-mail: soyasummit@soyatech.com, Web: www.soyasummit.com
- November 8, 2009. "20th IAOM Latin America District Annual Conference and Expo." Buenos Aires, Argentina. Contact: Sherri Ford, Director of Meetings and Exhibits. IAOM, International Association of Operative Millers, 5001 College Blvd. Suite 104, Leawood, KS 66211, USA. Tel: 1 (913) 338-3377, Fax: 1 (913) 338-3553, E-mail: sherri.ford@iaom.info, info@iaom.info, Web: www.iaom.info
- November 17–19, 2009. "GlobalGrain 2009 Conference." President Wilson Hotel. Geneva, Switzerland. Contact: Andrew Osborne, Tel: 44 (0) 208 892 4821, London. James Dunsterville, Tel: 41 22 329 4548, Geneva. E-mail: conference@globalcommoditiesgroup.com, 2010
- March 23–26, 2010. "2010 Food Safety Education Conference, Advancements in Food Safety: Trends, Tools and Technologies." Hyatt Regency. Atlanta, GA, USA. Contact: Web: www.fsis.usda.gov/Atlanta2010.
- April 15–18, 2010. IBATECH'10. Trade Fair For Bakery, Patisserie Machinery, Ice Cream, Chocolate and Technologies. Istanbul Expo Center, CNR Expo. Yesilköy, Istanbul, Turkey. Contact: Funda Kunduz, Project Manager. Ares Fuarcilik Ltd. Xti. Binbir Çiçek Sok. Naciye Apt. No: 3 Kat: 3 D: 9 Levent, Istanbul, Turkey. Tel: +90 (212) 284 1110, Fax: +90 (212) 284 1001, E-mail: funda@aresfuarcilik.com, info@aresfuarcilik.com, Web: www.aresfuarcilik.com, www.ibatech.com.tr
- April 19–23, 2010. 114th Annual IAOM Conference & Expo in North America Las Vegas Hilton Hotel and Las Vegas Convention Center. Las Vegas, NV, USA. Contact: Sherri Ford, Director of Meetings and Exhibits. IAOM, International Association of Operative Millers, 5001 College Blvd. Suite 104, Leawood, KS 66211, USA. Tel: 1 (913) 338-3377, Fax: 1 (913) 338-3553, E-mail: sherri.ford@iaom.info, info@iaom.info, Web: www.iaom.info
- April 29–May 4, 2010. Istanbul Fair of Milling Machinery Related Industries & Grain Technologies, IDMA 2010. World Trade Center. Istanbul, Turkey. Contact: PARANTEZ Uluslararası Fuar Yapım Tic. Ltd. Xti. Güllübag Mah. Cemal Sururi Sok. Halim Meriç Is Merkezi No: 25 Kat: 7 Daire 35 Mecidiyeköy, Istanbul. Tel: (212) 347 3164 (PBX), Fax: (212) 212 0204, E-mail: info@parantezfair.com, Web: www.parantezfair.com
- July 17–21, 2010. "Institute of Food Technologists Annual Meeting and Food Expo." Chicago, IL, USA. Contact: IFT, 221 N. LaSalle St. Suite 300, Chicago, IL 60601-1291, USA. Tel: +1 (312) 782 8424, Fax: +1 (312) 782 0045, E-mail: info@ift.org, Web: www.ift.org
- August 22–26, 2010. "The 15th IUFOST World Congress of Food Science and Technology, "Food Science Solutions in an Evolving World." Capetown, South Africa. Contact: Web: www.iufost2010.org/za

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Preserving Food After Harvest Is an Integral Component of Food Security

Some History of Postharvest Food Loss Reduction Activities

Ever since foreign aid to developing countries became a common practice shortly after the end of World War II, numerous efforts were made to reduce postharvest food losses in developing countries. Most of these programs were sporadic and short-lived because they depended on the foresight and enthusiasm of one or two people on location in a developing country. The programs usually expired after the instigator of a program completed their assignment and returned to their homeland. This piece-meal localised approach occurred without recognition at high policy levels.

Policy-level recognition of the problem began when the attention of the world was drawn to the problem of postharvest food losses by the U.S. Secretary of State, Dr. Henry Kissinger, at the World Food Conference that was held in November 1974 in Rome. In his keynote address at the opening session of the World Food Conference Secretary Kissinger said, "Another major priority must be to reduce losses from inadequate storage, transport, and pest control. Tragically, as much as 15% of the country's food production is often lost after harvesting because of pests that attack grains in substandard storage facilities. Better methods of safe storage must be taught and spread as widely as possible. Existing pesticides must be made more generally available. Many of these techniques are simple and inexpensive; investment in these areas could have a rapid and substantial impact on the world's food supply."

The attention of the political world was again drawn to the problem of postharvest food losses by Secretary Kissinger the following year in an address presented at the 7th special session of the United Nations General Assembly on 1 September 1975 in New York. In this address Secretary Kissinger said, "Another priority in the poorest countries must be to reduce the tragic waste of losses after harvest from inadequate storage, transportation, and pest control. There are often simple and inexpensive techniques to resolve these problems. Investment in such areas as better storage and pesticides can have a rapid and substantial impact on the world's food supply; indeed, the savings could match the total of the food aid being given around the world. Therefore, we urge that the Food and Agriculture Organization, in conjunction with the UN Development Program and the World Bank, set a goal of cutting in half these postharvest losses by 1985, and develop a comprehensive program to this end."

This challenge from Secretary Kissinger was taken up by the United Nations in that session and on 19 September 1975 one of the resolutions of the UN General Assembly was: "The further reduction of postharvest losses in developing countries should be undertaken as a matter of priority, with a view to reaching at least 50% reduction by 1985. All countries and competent international organisations should cooperate financially and technically in the effort to achieve this objective."

This resolution drew the attention of the highest levels of governments and donor organisations around the world to the problem of food losses and the potential contribution that reducing these losses can make to the improvement of the nutritional status of the poor. The resolution is realistic; it recognises that food losses will never be reduced to zero but calls for efforts to reduce sharply the high levels of loss that presently occur. Conservative estimates indicate that more than 100 million tons of cereal grains and legumes are lost each year in developing countries (NAS 1978). This is sufficient to provide the minimum energy requirements of about 300 million people.

A result of the 1975 UN resolution was that many governments and other agencies made it a policy to include a postharvest food loss component in their foreign aid programs. The U.S. Agency for International Development (USAID) initiated a number of programs including commissioning a report from the U.S. National Academy of Sciences.

This report is still the standard reference in the field. Governments in the Europe Union, Japan, Canada, and Australia also initiated postharvest food loss programs. Many good programs were put in place, and substantial reductions in food losses were achieved in some developing countries.

However, that 1975 UN resolution was passed more than thirty years ago. The scientists who carried out those postharvest activities in the field have retired. Most of the excellent programs of the late 1970s and 1980s have expired and not been renewed. Policy has moved away from the initial focus on preserving raw agricultural commodities to include all activities from harvest to consumption with greater attention given to processing technologies that convert raw products into foods ready to eat. The programs that are still active have generally shifted emphasis from reducing losses to help the malnourished to improving the quality and safety of foods exported from developing countries to developed countries. It seems that postharvest has fallen off the policy agenda for most governments and donor agencies. However, there are still millions of hungry people.

In my travels to developing countries I have been shocked to see the devastating effects of under nutrition. As a food technologist, I have been even more shocked to see how much food in these areas is lost after it is harvested and how poor is the quality of much of the food that is eaten. It does not have to be this way. There is a rich and abundant body of knowledge on how to preserve unprocessed agricultural commodities until they are ready for preparation for consumption. How can we re-awaken interest at the highest policy levels on the need to assign resources to preventing spoilage of already harvested food in developing countries?

A Challenge

The resources allocated to postharvest food loss reduction in the 1970s to 1980s were a direct result of the speeches of Dr. Kissinger to the United Nations General Assembly in 1974 and 1975. I challenge the readers of this paper to find a prominent person who will make a similar speech to the United Nations or similar prestigious organisation that will trigger the allocation of significant resources by governments and donor organisations to reducing postharvest food losses in developing countries.

Reproduced with permission of Prof. Malcolm Bourne, Cornell University, NY and The World of Food Science (www.worldfoodscience.org).

NC-213 Has Impact

Funding Sources Make Impact

NC-213 scientists successfully leveraged multistate research projects to obtain funding from The Andersons, Michigan State Millers' Association, other Cereal Industry, US Agency for International Development, NIH Initiative for Minority Scientific Development, the North Dakota Wheat Commission, North Dakota Agricultural Utilization Commission, the Energy Center – Discovery Park – Purdue U., USDA-SBIR, and USDA-FGIS. These funds led to implementation of several programs focused on enhancing quality, safety, and security for the U.S. grain supply. These programs directly and indirectly impact the U.S. and international grain industry from production agriculture through the consumer level.

Transportation and Logistical Challenges of Biotechnology

Issue

Biotechnology is beginning to revolutionize agricultural production, especially for grains and oilseeds. Varietal improvements that have resulted in herbicide tolerance and insect resistance are increasing yields and reducing production costs for farmers. The next wave of advances in seed genetics will bring new varieties to the market with characteristics tailored for end-user feeding and food processing. Increased yields and production of end-user-specific varieties will create new challenges for transportation and logistics.

Background

Since 1987, the USDA has approved or acknowledged 3,855 field trials of new agricultural products that are derivatives of 48 different plant species. More than 80 percent of these trials have occurred during the past 4 years. Corn continues to be the major crop involved in these field tests. As new plant varieties have come to the market, producers have been quick to incorporate these advances in biotechnology into their farming operations.

In 1996, U.S. farmers planted the first commercially available, insect-resistant corn and herbicide-tolerant soybeans. The corn varieties were modified with a gene from *Bacillus thuringiensis* (Bt) to have built-in resistance to the European corn borer. The soybean varieties were modified to have tolerance to the herbicide Roundup®. In 1997, U.S. farmers planted 4 percent (3 million acres) of their corn acreage in Bt corn varieties and 15 percent of their soybean acreage (11 million acres) in Roundup Ready® soybean varieties. Estimates for 1998 are that 10 percent (8 million acres) of U.S. corn acreage was planted in Bt varieties and an additional 10 percent was planted with herbicide-tolerant corn varieties. U.S. soybean producers are estimated to have planted as much as 30 percent (22 million acres) of their soybean acreage with herbicide-resistant varieties this year.

These first bioengineered crop varieties had specific agronomical characteristics that resulted in improvements in yield and reductions in production costs. Beyond herbicide tolerance and insect and disease resistance, however, are a broad range of varietal characteristics that can be tailored through biotechnology to meet the specific needs of different end users. For instance, the ability to produce corn and soybeans with specific amino acids and protein profiles offers the potential for improved feeding rations at lower costs for livestock and poultry feeders. High-lysine and high-methionine corn and soybeans, for example, provide essential limiting amino acids in rations without the need for synthetic feed additives. Low-phytate corn

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varieties can help reduce the environmental problems associated with livestock and poultry production by reducing phosphorus concentrations in animal waste. The modification of oilseeds through biotechnology can improve nutritional and health qualities of vegetable oil and margarine and provide functional benefits in food processing operations. High oleic acid soybeans contain less saturated fats than regular soybeans and have improved heat stability. High-stearate canola and soybeans have the potential to increase the functionality and shelf stability of margarine and shortening. Finally, biotechnology offers the potential for designing crops, such as corn, with unique polymers and chemicals for use in industrial and manufacturing applications.

Grains and oilseeds with specialized end-use characteristics can command significant price premiums for farmers. Some specialty grains, like high-oil or waxy corns for instance, have historically yielded below the standard “dent” varieties, which has made the production of these specialty grains less profitable for farmers despite the price premiums. However, biotechnology offers the potential to stack specific end-use qualities and agronomical characteristics that are already increasing yields for producers. This ability to “manufacture” grains and oilseeds according to specific end-use needs with the yields of commercial varieties represents a tremendous opportunity to increase the volume of grains and oilseeds produced for specific end-use markets.

Large-scale shifts away from commodity-based grain and oilseed production seem right around the corner with new seed

varieties coming on the market at an ever-quickening pace. Seed companies are reducing the development cycle of new products by as much as two-thirds every decade. With the ability to produce seed in South America during the North American winter, seed companies can make new seed varieties available to farmers faster than ever. Improvements in genetics may outpace changes in handling and transportation that will be necessary for producers and end users to capture the increased economic value of speciality crops.

Implications

Biotechnology offers the potential to produce significant volumes of specialty grains and oilseeds with high-value traits designed for specific end uses. Moving these crops from the farm to the processor or end user will present a major challenge for the U.S. grain-handling and transportation system. The present U.S. system has evolved to move undifferentiated bulk grains and oilseeds. The efficiency and cost effectiveness of this system rely upon the fungibility of commodities that are easily standardized by a few grades or classes. The ability to preserve the identity of specialty grains and oilseeds from farm to end user will be necessary if the increased value of these crops is to be realized by users and reflected in price premiums sufficient to encourage production.

Widespread acceptance of specialty grains and oilseeds is dependent upon the ability of the handling and transportation system to deliver these crops to end users in consistent volumes, at consistent levels of quality, and with consistent end-use characteristics, at competitive prices. This means adapting some parts of the existing grain-handling and transportation infrastructure to allow for identity preservation. It may also mean developing entirely new marketing channels and delivery systems. Regardless, identity-preserved handling and shipping costs will have to be low enough that they do not erode the end-use value of specialty grains and oilseeds. Without sufficient price incentives for these crops at the farm gate, producers will not produce volumes sufficient to justify end-user shifts in feeding rations or processing operations.

Handling and transportation alternatives must emerge that reflect the very real economics of producing and using specialty grains and oilseeds. One alternative may be producing specialty varieties in areas directly adjacent to the intended end users so truck hauls can be short and cost effective. Another alternative may be concentrating production in the traditional growing regions in densities sufficient to generate volumes that can move longer distances competitively by barge or by rail under multiple-car and unit-train rates. Whichever market solution evolves, the future of biotechnology in grain and oilseed production is very much tied to the ability of the U.S. handling and transportation infrastructure to facilitate low-cost, identity-preserved shipping for these new types of agricultural commodities.

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Jerry Norton, World Agricultural Outlook Board, USDA, 202-720-4205

NC-213 Engineers, Scientists, Economists Share Their Research ...

NIR Absorbance Characteristics of Deoxynivalenol and of Sound and Fusarium-Damaged Wheat Kernels

Authors: K. H. S. Peiris, M. O. Pumphrey, and F. E. Dowell
Submitted to: Near Infrared Spectroscopy Journal

Fusarium head blight is a fungus that causes yield losses in wheat and barley, produces the mycotoxin deoxynivalenol, and affects end-use functionality. Detecting the fungus or toxin in single kernels will help breeders rapidly and objectively evaluate lines for resistance. Also, sorting kernels based on the presence of the fungus or level of toxin may help breeders select for resistance to the fungus or toxin within lines. We measured near-infrared absorption spectra of pure deoxynivalenol, and kernels with and without the toxin or fungus. Specific peaks in the pure toxin were related to those seen in infected kernels. Other differences in infected and uninfected kernels were attributed to changes in the levels of grain food reserves related to the invasion of the fungus. This information will be used to improve near-infrared calibrations used to sort single kernels based on Fusarium infection or DON levels. This work was partially funded by the U.S. Wheat and Barley Scab Initiative and supports work by breeders to develop lines resistant to Fusarium head blight.

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Measuring Grain and Insect Characteristics Using NIR Laser Cluster Technology

Authors: F. E. Dowell, E. Maghirang, and V. Jayaraman
Submitted to: Applied Engineering in Agriculture

A simple, low-cost, laser-based spectrometer was evaluated for measuring various grain and insect traits. This system is potentially much faster, cheaper, and more accurate than conventional near-infrared spectrometers. We evaluated the accuracy of this system for measuring wheat hardness, protein content, moisture content, and waxy character. We also used the system to determine the sex of tsetse fly pupae for potential sterile insect technique eradication programs. The laser cluster system predicted wheat hardness, moisture content, and fly sex with an accuracy similar to the near-infrared system, but predicted other traits with slightly less accuracy. The laser cluster system was limited to 8 wavelengths, and the accuracy of predicting other traits may be improved if different wavelengths were selected. This technology may provide a low-cost alternative for measuring some grain and insect traits.

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Predicting the Concentration and Specific Gravity of Biodiesel-diesel Blends Using Near-infrared Spectroscopy

Authors: M. Coronado, W. Yuan, D. Wang, and F. E. Dowell
Submitted to: Applied Engineering in Agriculture

Biodiesel made from different source materials can have different physical and chemical properties. Also, the concentration of biodiesel in biodiesel-diesel blends varies from pump to pump and from user to user. These factors can significantly affect the performance and efficiency of engines fueled with biodiesel. To address these challenges, models based on near-infrared spectroscopy were developed for relatively inexpensive and rapid on-line measurement of the concentration and specific gravity of biodiesel-diesel blends. Five different oils—soybean oil, canola oil, palm oil, waste cooking oil, and coconut oil—and two different brands of commercial-grade No. 2 on-highway diesel and one brand of off-road No. 2 diesel were used in the calibration and validation processes. The predicted concentration and specific gravity of the biodiesel-diesel blends were compared with the actual values. The average prediction error of biodiesel concentrations was about 3%. The specific gravity prediction model had an average error of 0.002. This information is necessary to develop engine electronic control units to adjust fuel injection timing for optimum engine performance.

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Grain Elevator and Processing Society and Kansas State University (GEAPS-KSU) to Offer Four New Distance-Learning Courses in 2010

The following courses will be offered between January 1, 2010 and July 4, 2010:

- Quality Management Systems for Bulk Materials Handling Operations
Dr. Charlie Hurburgh, Jr., Iowa State University
- Stored Grain Pest Management Practices and Fumigation
Dr. Subramanyam Bhadriraju, Kansas State University
- Hiring and Retaining Good Workers in the Grain Industry
Barb Quandt, West Central
- Equipment Maintenance in the Grain Industry
Gary Sondgeroth, PMI LLC

Additionally, six current GEAPS-KSU courses will be offered again in 2010:

- Safety Management
- Grain Quality Management
- Fundamentals of Ethanol Production
- Electrical Safety for Grain Facilities
- FGIS Grain Inspection Orientation
- Aeration System Design and Operation