

Quality Grains and Processing Co-Products

NC-213 (2008-2013)

Grain Quality Issues

High quality foods, animal feed, and fuels start with high quality grain. Different uses require grains with different traits. Current technologies and protocols for measuring and monitoring grain traits can be inaccurate, inefficient, and expensive. Handling, storing, and transporting grain can also cause a number of grain quality issues. For example, pests and diseases can contaminate grain during storage, making any food produced from the grain unsafe for human or animal consumption, and grain can break or crack during handling, transport, and drying, making it unsuitable for certain uses. As production rises to meet soaring demands, more grain is being stored on farms and in commercial facilities for longer amounts of time, and maintaining grain quality is becoming even more challenging. When grain is processed into fuel, other residual materials are produced, and these “co-products” require their own set of handling, storing, transporting, and marketing practices to reduce waste and make biofuels processing sustainable.

Multistate Research Project Improves Grain Production & Marketing

Since forming in 1975, Multistate Research Project NC-213 has provided opportunities and resources for researchers across the U.S. to collaborate and address engineering, biological, and economic issues associated with supplying grain to processing industries. For the past five years, the group has focused on describing and maintaining the quality of cereal and oilseeds grains and biofuel co-products and coordinating with markets and industry. These efforts have reduced grain losses between harvest and end product, produced higher quality end products, and saved farmers and processors time and money.

Understanding which traits are desirable and having the tools to sort grain makes it **easier for farmers and breeders to create new crop varieties**. This makes it **possible to affordably produce grains that meet specific qualifications**, enabling processors, millers, and bakers to **provide high quality products for consumers**.

- Researchers identified which grain characteristics are important for making high quality sponge cake, baked bread, Chinese noodles, and spaghetti noodles.

NC-213 researchers developed **new uses and markets for alternative crops**.

- Researchers determined that alternative grains (such as sorghum, flaxseed, and spelt) can be used to **manufacture products with improved nutritional aspects like higher fiber and antioxidant levels**. For example, they have produced gluten-free sorghum bread, tortillas, and noodles, which have **less impact on blood sugar and calorie intake and are desirable choices for individuals suffering from diabetes, celiac disease, or gluten allergies**.



Grain losses can occur after harvest, especially during storage, transport, and processing. For example, Fusarium head blight (FHB, shown infecting barley in these two images) is a fungal disease of grain crops that causes yield reductions of up to 50%. Crop losses due to FHB have exceeded \$1 billion in the U.S. FHB can also produce toxins that can make grain unsafe for consumption. Photo by Janet Lewis/CIMMYT, Flickr. Creative Commons License 2.0.

Farmers using new pest and disease detection and prevention practices have **reduced grain losses and avoided use of chemical intervention**. These changes **lower production costs and protect humans and the environment from unsafe grain and harsh chemicals**.

- Researchers developed a Raman spectroscopy method for screening corn that is non-destructive, easy, rapid, and inexpensive. Screening capability makes it possible to divert contaminated grain away from the food supply and into other uses, so that **producers can still profit while keeping consumers safe and satisfied**.
- NC-213 also developed a low-cost system to detect insect infestations in wheat kernels, helping farmers and processors **take action before the pests cause too much damage**.
- NC-213 put together a test kit that accurately determines the risk of spoilage during shipment.
- Another NC-213 innovation, a CO₂ sensor system for grain storage structures, can detect spoilage due to insects and molds **three to four weeks prior to traditional methods**.
- To even further ensure product safety, NC-213 is encouraging the use of systems for tracing and auditing grain.

NC-213 research is also **improving the sustainability of the biofuels industry.**

- NC-213 study results are **encouraging farmers to change their farming practices**—for example, delaying planting or increasing nitrogen fertility—in order to produce grain with the right composition for biofuels processing. These changes can have an impact of **two to four million dollars per year** at the ethanol plant due to better ethanol yields.
- NC-213 research is also **increasing the marketability of co-products of biofuel processing.** For example, researchers determined that significant amounts of co-products can be used in swine diets, thus **reducing concerns about conflict between growing grain for feed versus growing it for fuel.**

NC-213 has also **boosted the number of trained industry professionals** in grain processing operations.

- Specifically, Iowa State University's training efforts have given FDA inspectors a **better understanding** of food safety risks associated with feed production.
- Distance learning programs have been incredibly successful, enrolling almost 2,000 participants from 27 countries over the past seven years, thus **reaching more and more growers and processors with new knowledge and technologies.**



Seed sorting machines developed by NC-213 have shortened production time for yellow flax (pictured above) by one year, increased production by 20%, and reduced contaminants by 90% compared to past practices. Photo courtesy of Veganbaking.net Flickr, Creative Commons License 2.0.



A popcorn producer is testing NC-213 technology that could help them sort and remove popcorn kernels that are damaged by fungus. NC-213 also built a low cost sorting device using a standard personal computer and color camera that can detect and separate many types of weed seeds, discolored seeds, and infected seeds. This device's accuracy is 15% to 20% higher than that of traditional sorters. Four wheat breeders in the U.S. have already adopted this device as their tool of choice for separating red and white wheat. Photo by X. Fonseca/CIMMYT, Flickr.Creative Commons License 2.0.

Want to know more?

NC-213 was supported, in part, through USDA's National Institute of Food and Agriculture by the Multistate Research Fund established in 1998 by the Agricultural Research, Extension, and Education Reform Act (an amendment to the Hatch Act of 1888) to encourage and enhance multistate, multidisciplinary research on critical issues that have a national or regional priority. For more information, visit <http://ncra.info/>.

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Participating Institutions:

University of Illinois-Urbana	Texas A&M University
Iowa State University	Texas AgriLife Research
Kansas State University	University of Wisconsin
University of Kentucky	AgriGold Hybrids
University of Missouri-Columbia	The Andersons, Inc
Montana State University	Centrec Consulting Group LLC
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