

## NC-213 PROGRESS REPORT FOR 2024

### **Title**

Utilization of the new ISU Kent Feed Mill and Grain Science Complex for Research, Education and Outreach

### **Investigators**

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### **Outputs/Research Updates**

The new ISU Kent Feed Mill and Grain Science Complex is a unique state-of-the-art facility that was commissioned and operationalized in 2023. It has a self-contained feed manufacturing tower, stand-alone pilot plant, ingredients warehouse, quality lab, classroom, and complete grain handling, drying and storage center. Its mission furthers ISU's research, teaching, service, Extension, and industry and international outreach in support of the global grain, feed and animal industries. Capabilities, operationalization efforts, licenses and registrations were summarized in the 2021, 2022 and 2023 NC-213 progress reports.

### **Outcomes/Impacts/Deliverables and updates of studies continued in 2024**

Over 2,100 people from 26 countries visited the facility as part of 136 tours and trainings in 2024 including from Bangladesh, Brazil, Cameroon, Canada, Chile, China, Colombia, Costa Rica, Cote d'Ivoire, Guatemala, Israel, Kenya, Mexico, Nicaragua, Nigeria, Peru, Rwanda, Senegal, South Africa, South Korea, Taiwan, Tunisia, Uganda, Ukraine, USA, and Vietnam. In-person, on-site trainings of domestic and international industry professionals focused on advanced feed manufacturing, mill operations management, grain and ingredient storage, co-products utilization, feed safety and quality management, regulatory compliance, and PCQI certification. The facility was also utilized for two grain entrapment rescue training workshops, one organized by the Ames Fire Department and the second by Nationwide Insurance through its Grain Bin Safety Week program. The latter targeted volunteers from two rural fire departments and resulted in the donation of state-of-the-art grain rescue tubes for the Franklin-Gilbert Fire Department and the ISU Kent Feed Mill and Grain Science Complex. Under the umbrella of the International Grain & Feed Industry Academy, faculty, staff and industry experts utilized the grain center for an on-site training of 17 industry professionals attending the *Advanced Bulk Material Handling & Grain Elevator Operations Management Short Course* in partnership with the Agri-Business Association of Iowa. A second course offering attended by 34 industry professionals was held off-site in Bloomington, Illinois in partnership with the Grain & Feed Association of Illinois.

Seven courses held class onsite during the calendar year with nearly 200 students gaining knowledge and perspectives in feed technology and grain science including the 3-credit Feed

Safety, Ingredient Quality and Analytics (TSM457/557) and Feed Processing and Technology (TSM455/555) courses required for completion of the ISU Feed Technology Minor. Both were taught entirely at the facility twice per week (4.5 h/week incl a 3-hour lab practical) with an enrollment of 11 and 21 students, respectively. The facility was the subject of three TSM415/416 Senior capstone projects involving 12 undergraduate students focused on improving roof access via two roof hatches, identifying options for installation of an electric site access gate, and evaluating truck wash sanitizing options to enhance biosecurity and feed safety. Four student organizations spent time touring the facilities with 55 students taking advantage of learning more about Complex and Academy offerings. The facility was also used in support of three graduate research projects described in separate reports, i.e., *Developing and Operationalizing a Quality and Food Safety Management System for the Iowa State University Kent Feed Mill and Grain Science Complex*, *Assessment and Modeling of Thermal Processes for Improved Process Optimization*, and *Assessment and Approaches for Achieving Net-Zero Carbon Emissions for Grain Drying, Handling and Storage Operations* (funded by an NC-213/Andersons Research Grant). Four USDA-FAS Scientific Exchange Program Scholars from Algeria, Senegal, Rwanda and Nigeria were hosted and trained with colleagues in Agricultural & Biosystems Engineering (Andersen) and Animal Science (Greiner, Koltjes, Appuhamy).

The grain center was commissioned, operationalized and utilized for the fall 2024 harvest. A total of 194,950 bushels of corn were received in 191 truck deliveries from nearby fields of ISU research and demonstration farms. Average corn moisture content was 14.9% with a standard deviation of 3.3 percentage points and a range of 10.2% to 24%. A total of 24,086 bu were dried from an average moisture content of 20.4% to 15.9% in a Sukup TM2410 mixed-flow dryer. Corn was graded according to USDA-FGIS procedures. Broken corn and foreign material (BCFM) averaged 0.58% with a standard deviation of 0.68 percentage points and a range of 0-3.81%. Test weight averaged 57.8 lb/bu with 1.79 lb/bu s.d. and a range of 51.8-62.0 lb/bu. Aggregated corn and corn screenings samples were tested for six mycotoxins (aflatoxins, fumonisin, DON, T2/HT2, ochratoxin A, zearalenone) using Neogen Reveal® Q+ MAX lateral flow test strips quantified with the Raptor® Integrated Analysis Platform lateral flow test strip reader with built-in incubation. All corn samples tested below the respective FDA maximum allowable or advisory or EU guidance or maximum levels for poultry feed. One screenings sample tested above the EU guidance level for fumonisin, six samples above the FDA advisory level for DON, and three above the EU maximum level for T2/HT2 for poultry feed, respectively. Given the few samples of screenings that tested positively, corn lots were not segregated for storage. Nevertheless, an SOP was established to screen-clean all corn transferred from storage to the feed mill, to test aggregated screenings and corn samples on a weekly basis, and to divert lots that test above limits to feed for other species such as beef. Corn is screen-cleaned with an EBM Gentle Roll 24M2-4-HB Triple Drum unit equipped with two sets of 4.78 square hole screens per drum. Corn is weighed in a Model CA1000 5,000 bushel per hour self-contained bulk-weigher from C&A Scales. Corn screenings are collected in seed boxes and weighed intermittently for each transfer. They are also analyzed for particle size and BCFM content as part of a graduate research project. Aeration cooling front movement and static pressure readings are also being quantified in two identical 54-foot diameter bins as a function of corn that was screen-cleaned before storage versus not, and corn being peaked versus cored.

The facility is managed by four full-time faculty and staff. In 2024 it was operated with assistance from four graduate students, three summer interns, and twelve hourly undergraduate students (one graduated and was hired as the facility's assistant production manager). The manufacture of heat-treated mash, pelleted and crumbled feed for a commercial partner was scaled up to an average of 175 tons per week by mid-year. Two to three 24-ton truck loads of finished feed are delivered each weekday to contracted genetic poultry layer producers in Iowa, Nebraska and Kansas.

## **Publications**

### ***Continuing Education Offerings***

- Advanced Grain Elevator Operations Management Short Course, Grain & Feed Association of Illinois (GFAI), Bloomington, Illinois, June 17-21, 2024. (Maier, Obeng-Akrofi, Sabbir, Marlow)
- Advanced Grain Elevator Operations Management Short Course, Agribusiness Association of Iowa (AAI), Ames, Iowa, August 5-9, 2024. (Maier, Obeng-Akrofi, Sabbir, Marlow)

### ***Virtual Presentations***

- USGC Saudi Arabia Corn & Co-Products Promotion Virtual Seminar for Al Watania Poultry Company, Saudi Arabia, August 11, 2024 (Maier: 1 lecture)

### ***Oral Presentations***

- Bangladesh Buyer-Seller Conference, U.S. Grains Council, Dhaka, Bangladesh, March 4-5, 2024 (Maier: 1 Lecture, 3 site visits)
- 15 TUYEM International Feed Congress and Exhibition, Antalya, Turkey April 18-21, 2024 (Maier: Invited Keynote)
- Feed Manufacturing Training Program, International Grain and Feed Industry Academy, Iowa State University, U.S. Grains Council Sub-Saharan Africa DDGS Team, May 7-8, 2024 (Ewing: 1 lecture, 1 tour; Akoto: 1 lecture; Obeng-Akrofi: 2 lectures)
- Good Manufacturing Practices (GMP) for Animal Nutrition, U.S. Grains Council Workshop, Cali, Colombia, September 26, 2024 (Maier: 1 lecture; 3 site visits)
- Feed Manufacturing Training Program, International Grain and Feed Industry Academy, Iowa State University, U.S. Grains Council South Asia Export Exchange Team, October 4, 2024 (Maier: 1 lecture; Ewing: 1 lecture, 1 tour)
- Strategic Approaches to Aquaculture Development in Africa, U.S. Grains Council Workshop, Hammamet, Tunisia, November 19, 2024 (Maier: 1 lecture)
- Artificial Intelligence in Agriculture Scientific Conference, 126th INAT Anniversary, Tunis, Tunisia, November 20, 2024 (Maier: Invited Keynote)
- Aquafeed Production, Perspective and Sustainability, U.S. Grains Council Workshop, Hammamet, Tunisia, November 21, 2024 (Maier: 1 lecture)

## **Funding Sources**

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