BioCentury Research Farm Summary

RFR-A2348

Andrew Suby, assistant director

Introduction

The BioCentury Research Farm (BCRF) continued to support a diverse group of users and projects in 2023. Iowa State University (ISU) faculty and staff from the Colleges of Engineering (COE), Design, and Agriculture and Life Sciences (CALS) continued to conduct research, teach, and perform outreach at the BCRF. Private industry users included Corteva, Deere and Company, Frontline Bioenergy, Gross-Wen Technologies (GWT), Hy-Vee Inc., Kemin, and others. During 2023, the BCRF had more than 93 full- and part-time users with projects and 40 student workers to support operations and research.

Research, Education, and Equipment

Algae. Research work continued at the BCRF to support advancements in using algae to remove nitrogen and phosphorus from wastewater. Additional projects that were funded through US DOE BETO grant program focused on cultivating rapidly growing algae strains for use as a biofuel and bioplastic feedstock. The BCRF continued to house the algae biofertilizer processing facility for GWT until company expansion outgrew the space leading to an opportunity for GWT to move to a larger space in Boone, Iowa. The fertilizer produced at the BCRF facility was used to fertilize parks, lawns, and golf courses throughout Iowa.

Biochemical. The Center for Crop Utilization Research (CCUR) continued to work at the BCRF in collaboration with industry partners at a high level of fermentation research activity. Working with BCRF staff, CCUR staff made significant improvements to the fermentation facility resulting in more efficient operations. Non-fermentation projects, such as milling, falling film evaporation, and drying wet cake to produce distiller's dried grains (DDG) using the BCRF's pilot-scale steam tube dryer were continued. In all, 26 different companies received services during 2023.

Biomass feedstock logistics. A multiyear stover storage project was extended with the Idaho National Laboratory (INL).

Biomass preparation. The BCRF continued to prepare biomass feedstocks for several internal and external clients. The farm's biomass preparation lab was used to fine grind, screen, size and pelletize the feedstocks. Various hammermills were used to provide biomass material for multiple clients and to prepare samples for the Agronomy and Architecture departments, the ISU Kent Feed Mill and Grain Science Complex, and others.

Biopolymer research. The Biopolymer Processing Facilit y was used in 2023 to manufacture several hundred pounds of biobased surfactants. These surfactants were in turn used to transform biopolymers into a water-based recycling agent used to pave 4 acres of the CyTown parking lot in 2023, as well as the floor of the Varied Industries Tent at the 2023 Farm Progress Show in Decatur, IL. The products are soy-based, replacing the petroleum-based binding agents used commercially as components in asphalt binder, as well as a variety of maintenance products for asphalt shingles, asphalt

pavement, and concrete. The research work is spearheaded by Eric Cochran, professor (CBE), Chris Williams, professor (CCEE), and the biopolymer team and is sponsored by the United Soybean Board and others.

Chassis Dynamometer Lab. Testing operations began in earnest with the completion of four industry-sponsored projects. The Cardinal Power Pullers ¼-scale tractor team were supported with small-scale equipment testing giving ISU students experience working with the test rig. ISU personnel completed major software enhancements giving the dynamometer the capability to simulate field and roading conditions for vehicles.

Digital Agriculture. The Digital Ag Innovation Lab continued growing their partnerships with industry, the ISU Research Park, and ISU Extension. Industry project sponsorship increased to a consecutive year new record high since the inception of the BioCentury Research Farm. In partnership with ISU Extension, the group has shared equipment, technology, and agronomic expertise with farmers around Iowa to aid them in making sound decisions for their farming operations. In recognition of ISU's Digital Ag excellence, the Technical Association of Iowa awarded the group the IT Service Provider Technology Company of the Year Award.

Polymer and Food Protection Program (PFPP). Work continued on various research projects including characterizing landfill plastic material, decontaminating waste plastics, producing new products, and creating compostable plastics by utilizing biomass feedstocks and other projects.

Thermochemical. The Bioeconomy Institute (BEI) continued its research partnership with Renewable Energy Group (REG) based in Ames, Iowa via the operation of a pilot-scale multi-reactor hydrotreater. The pilot plant is designed to support REG's Geismar, Louisiana renewable diesel plant and has been used to evaluate feedstocks and process variables that mimic the commercial facility. The system was able to maintain a significant uptime rating over the course of the research year and has provided REG with data that directly informs commercial operations.

Additionally, BEI has concluded a year of collaborative testing with an internationally based startup company using their 1kg/hr solvent liquefaction pilot plant. Plant results have informed the design of a larger scale pilot system the company is currently developing for the next phase of technology commercialization.

Educational support/Capstone. The BCRF hosted or gave class support to 324 ISU Agricultural and Biosystems Engineering (ABE) and other students which included seven classes and four Capstone projects sponsored by the BCRF and Digital Ag.

Outreach, Visitors, Events and Tours

Information dissemination and promotion are mainly accomplished through tours, conferences, and symposiums. The BCRF had 66 groups totaling 878 visitors in 2023. Since the dedication in 2009, BCRF has hosted 1,125 tours totaling 18,884 visitors.

The 2023 tours included visits by high school and potential ISU students, various Iowa and other public groups, industrial clients, international visitors from around the world, White House staff, and Members and staffers of the U.S. Congress.