BioCentury Research Farm Summary

Andrew Suby—assistant director

The BioCentury Research Farm (BCRF) supported a diverse group of users and projects in 2021. Iowa State University faculty and staff from the Colleges of Engineering (COE) and Agriculture and Life Sciences (CALS) continued to conduct research, teach, and perform outreach at the BCRF. Private industry users included Deere and Company, Gross-Wen Technologies (GWT), Kemin, Roeslein and others. During 2021, the BCRF had more than 48 full- and part-time users with projects, and 37 student workers to support operations and research.

Research, Education, and Equipment

Algae. Research work continued at the BCRF to support advancements in the removal of nutrients (nitrogen, phosphorus, and others) and toxic metals from municipal and industrial wastewaters. Increased focus on uses for the nutrient laden algae yielded potential uses in agricultural and other applications. GWT's laboratory and pilot scale-up research continued to take place at the BCRF.

Biochemical. The Center for Crop Utilization and Research (CCUR) continued to work at the BCRF with industry partners at a high level of fermentation research project activity. Non-fermentation projects, such as milling, fall film evaporation, and drying wet cake to produce dried distillers grains (DDG) using the BCRF's pilot-scale steam tube dryer were continued. In all, 10 different companies received services during 2021.

Biomass feedstock logistics. Multiyear stover and prairie grass storage and testing projects came to a close in 2021. Planning for 2022 projects was discussed. Various biomass feedstocks were prepared for industrial use.

Biomass preparation. As it has for over a decade, 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 department and others.

Biopolymer research. The Biopolymer Processing Facility produced the final phase of biopolymer components for producing asphalt. The scale-up information produced by the biopolymer plant enabled the commercial translation to full-scale facilities, producing 100 tons of biopolymer products in 8,000-gallon reactors. 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), and the biopolymer team and is sponsored by the United Soybean Board and others.

Digital agriculture. The digital ag group maintained continuity of research with partners in spite of COVID-19-related disruptions and contributed digital ag and ag equipment expertise to ISU Extension and Outreach programming. The group created two new lab spaces at the BioCentury Research Farm for continued development of new projects, and provided on-site space and resources to research partners to enable them to continue research and development while under travel restrictions.

Thermochemical. The Bioeconomy Institute (BEI) completed the design, construction, shakedown, and initial operation of a pilot scale multi-reactor hydrotreater, which is the culmination of a three-year collaboration with Renewable Energy Group (REG) based in Ames, Iowa. The pilot plant is designed to support REG's Geismar, Louisiana, renewable diesel plant and will be used to evaluate feedstocks and process variables. The fully automated system is designed to safely operate for weeks-long campaigns with minimal operator input.

Additionally, the BEI has reconfigured its 1kg/hr solvent liquefaction pilot plant to utilize a new proprietary solvent system done in collaboration with an internationally based startup company to evaluate its efficacy on a continuous system. Construction, shakedown, and initial trials are anticipated to be conducted in the first quarter of 2022.

Educational support/capstone. The BCRF hosted or gave class support to 171 ISU Agricultural and Biosystems Engineering (ABE) and other students which included six classes and three capstone projects.

Facility and equipment improvements. Construction continued on the new off-road vehicle chassis dynamometer donated by Danfoss. Ninety percent of the structural installation was completed. Despite a 10-month delay due to COVID-19 travel restrictions, a manufacturer representative arrived from England and began to commission the unit in November. The remaining installation, commissioning, and training is scheduled to be completed in 2022.

Preparations to move a vehicle test stand to a new location in the middle hoop shed were undertaken in the fourth quarter of 2021. Gravel base upgrades and the addition of a concrete pad and new electrical service were completed.

The north parking lot was doubled in size by adding a new gravel lot north of the existing bioasphalt lot. This new lot allowed for adequate parking for large gatherings such as the REG ribbon cutting.

Major repairs were completed to restore the septic mound pump station and above ground tank pump station to reliable operation.

As a part of the equipment building remodel for the dynamometer, the east end of the building was upgraded to support Dr. Keith Vorst's (Food Science and Human Nutrition) research group. New electrical panels were installed to support equipment operation such as extruders and injection mold machines. An Americans with Disabilities Act (ADA) compliant bathroom also was installed.

Outreach, Visitors, Events and Tours

Information dissemination and promotion are mainly accomplished through tours, conferences, and symposiums. As in 2020, a reduced number of tours were provided in 2021 due to COVID-19 restrictions. The BCRF had 17 groups totaling 301 visitors in 2021. Since the dedication in 2009, BCRF has hosted 984 tours totaling 16,876 visitors.

The 2021 tours included visits by potential students, industrial clients, WHO Radio, and governmental officials.