Research to power the next generation of biofuels and biobased products

www.biocenturyresearchfarm.iastate.edu
The BioCentury Research Farm is the premier integrated biomass to fuels and products production and processing facility in the nation. With capabilities not available at other public institutions, the BCRF can initiate and conduct research and demonstration of new technologies.

The BCRF brings together scientific expertise to accelerate innovation and production capacity associated with biobased fuels, chemicals and products.

Our modern facilities and equipment are available to aid research activities including biomass feedstock production and cropping systems; harvest, storage and transportation logistics of biomass feedstocks; and biomass conversion. Large pilot-scale research can be carried out and in many cases scaled to commercial production.

We provide a venue for educating and training future scientists, producers and Extension experts and developing partnership opportunities with industry.

The BCRF is a College of Agriculture and Life Sciences facility and is managed by the Center for Crops Utilization Research.

**OUR MAIN SERVICES**

» Research plots and acreages for feedstock production

» Year-round development and testing of harvest, storage and transport equipment

» Hydraulic presses for biomass compaction studies

» Dry storage for up to 40 tons of biomass

» Handle, dry and mill up to 2.5 tons of biomass per day

» Fine milling, sieving and pelletizing

» Large pilot-scale biochemical conversion of biomass including a dry-grind ethanol plant

» Thermochemical processing using pilot-scale fast pyrolysis and gasification

» Pilot-scale algal cultivation systems

» Large pilot-scale biopolymers processing

» Support for small business incubator activities

» Technical consulting services
Substantial research plots and large-scale acreages are available for biomass feedstock production. Research program areas include plant breeding and genomics, crop selection and development, comparative cropping systems, soil conservation and nutrient management.
Research-driven innovation will improve the efficiency and economic feasibility of biomass harvesting and transportation technologies. Project areas focus on developing in-field harvesting and densification methods, biomass logistics and materials handling. Biomass production and harvesting equipment and methods are tested year-round.

Biomass feedstock storage research trials are conducted in controlled and real world environments. Alternative storage systems are available and tested on-site. Corn stover bale storage trials are conducted without protection, under tarps and in enclosed buildings. Three hoops structures are available for projects. These trials help identify the most cost-effective storage systems for different biomass crops.

Biomass feedstocks can be dried, ground and sized in the biomass storage and pretreatment building. Various dryers, grinders, mills and sieves are available to process biomass for biofuels projects. The building also features a fine particle biomass preparation lab that is used for fine grinding, sieving, pelleting, milling, briquetting and particle size distribution determination. The lab is designed to accommodate 12 independent equipment stations. The BCRF is one of the few facilities in the nation capable of grinding and sizing large quantities of research quality biomass feedstocks while still accommodating small-quantity projects.
All major thermochemical pathways to biofuels and bioproducts are being explored including gasification to syngas and fast pyrolysis to bio-oil. These substrates will be upgraded to a variety of biofuel products: hydrogen, ethers, alcohols and hydrocarbons. The pilot-scale gasifier is capable of processing up to one-half ton of biomass per day and the pilot-scale fast pyrolysis unit is able to process up to one-quarter ton per day. A gas cleaning system, downstream of the gasifier, removes contaminants.

**Research**

» Fast pyrolysis and bio-oil upgrading
» Production and recovery of pyrolytic sugars
» Gasification and syngas cleaning
» Solvent liquefaction
» Biochar
» Biopower
» Algae conversion
» Biorenewables systems analysis
Biochemical processing research will further develop pretreatment, fermentation and ethanol recovery strategies to enable successful commercialization of biofuels and biochemicals. The BCRF is equipped to replicate the entire dry-grind ethanol process at large pilot scale, allowing researchers to develop new technologies to reduce water and energy consumption in grain ethanol production. Industry and faculty also use the facility to scale-up new biotechnology products and processes for crop seed technologies through finished consumer products.

**Equipment**

- Fermentation vessels (50-, 200-, 500- and 1,000-liter working capacities)
- Horizontal decanter centrifuge
- Membrane filtration system
- Distillation column
- Stillage evaporator
- Pilot-scale rotary steam tube drying system (500 pounds of DDGS capacity per day)
ALGAE PRODUCTION

The 720-square-foot algal production facility is equipped to quickly grow substantial amounts of algal biomass for on- and off-campus research projects including renewable fuels, biobased products, nutraceuticals and livestock feed. It enables researchers to conduct pilot-scale research year-round in a geothermally heated and cooled greenhouse. Approximately 1.3 to 4.5 kilograms of dried algal biomass can be produced per week.

The facility is outfitted with various cultivation systems including two 3,000-liter raceway ponds, four 200-liter flat panel photobioreactors and one 250-square-foot biofilm-based reactor. A portable pilot-scale algal biomass production system is available to set up at remote locations. The facility also has a research lab outfitted with smaller cultivation systems and growth and sample analysis equipment.

BIOPOLYMERS PRODUCTION

The biopolymer processing facility converts vegetable oils into thermosets – soft rubbery polymers that can be melted and re-formed over and over again. The facility can make about 1,000 pounds of biopolymers per day. They will be used for evaluation in several different industries including asphalt paving, adhesives, coatings and packing materials.
WAYS TO COLLABORATE

The BCRF offers a variety of opportunities for Iowa State University scientists and industry clients to collaborate on research projects and have access to our unique facilities and equipment. These collaborations will provide solutions that pave the way to meet national energy, economic and environmental directives.

OPPORTUNITIES FOR INDUSTRY

**Collaborative Projects** – Work with BCRF faculty and staff through joint solicitations or industry sponsorships.

**Fee for Service** – Conduct research on-site using BCRF facilities and expertise.

**Space and Equipment Leases** – Lease space and equipment to conduct proprietary research.

**Industry Incubator** – Locate your company or organization at the BCRF to carry out proprietary research and development.

OPPORTUNITIES FOR SCIENTISTS

Iowa State University scientists are invited to join the BCRF. By becoming an affiliate, researchers can receive a number of benefits including access to field plots and equipment, access to BCRF facilities and equipment and opportunities for research team development.

The BCRF assists affiliates with industry collaborative grant proposals and coordinates administration of contracts and results reporting. Affiliates can receive help connecting with companies to commercialize technologies developed in their research programs.

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