

2012

# BioCentury Research Farm Update

Andrew A. Suby

*Iowa State University*, [asuby@iastate.edu](mailto:asuby@iastate.edu)

Follow this and additional works at: [http://lib.dr.iastate.edu/farms\\_reports](http://lib.dr.iastate.edu/farms_reports)



Part of the [Agriculture Commons](#)

---

## Recommended Citation

Suby, Andrew A., "BioCentury Research Farm Update" (2012). *Iowa State Research Farm Progress Reports*. 15.  
[http://lib.dr.iastate.edu/farms\\_reports/15](http://lib.dr.iastate.edu/farms_reports/15)

This report is brought to you for free and open access by Iowa State University Digital Repository. It has been accepted for inclusion in Iowa State Research Farm Progress Reports by an authorized administrator of Iowa State University Digital Repository. For more information, please contact [digirep@iastate.edu](mailto:digirep@iastate.edu).

---

# BioCentury Research Farm Update

## **Abstract**

The BioCentury Research Farm (BCRF) had a diversity of users in 2011. Iowa State faculty and staff from agricultural and biosystems engineering (ABE), agricultural systems technology (AST), agronomy, chemical and biological engineering (CBE), civil, construction, and environmental engineering (CCEE), food science and human nutrition (FSHN), horticulture, mechanical engineering (ME), and natural resource ecology and management (NREM) conducted research, teaching, and outreach at the BCRF. Private industry users included Avello Bioenergy, DCE, Frontline BioEnergy, and Virent, Inc.

## **Keywords**

RFRA11130

## **Disciplines**

Agriculture

## BioCentury Research Farm Update

### RFR-A11130

Andrew Suby, manager  
BioCentury Research Farm

#### Upgrades and Research

The BioCentury Research Farm (BCRF) had a diversity of users in 2011. Iowa State faculty and staff from agricultural and biosystems engineering (ABE), agricultural systems technology (AST), agronomy, chemical and biological engineering (CBE), civil, construction, and environmental engineering (CCEE), food science and human nutrition (FSHN), horticulture, mechanical engineering (ME), and natural resource ecology and management (NREM) conducted research, teaching, and outreach at the BCRF. Private industry users included Avello Bioenergy, DCE, Frontline BioEnergy, and Virent, Inc.

A group of CALS students participated in assembling the utility all-terrain vehicle (UTV) prize for Successful Farming magazine's UTV Raffle. The UTV was upgraded at the BCRF and a Successful Farming reporter shot photos of the UTV and developed an article for publication. By the end of December 2011, the BCRF had over 75 full- and part-time users with projects in more than 90 percent of available space.

In 2011, a great deal of research project activity occurred at the BCRF. The Harvest, Storage, and Transportation (HST) Facility supported multiple projects led by Drs. Matt Darr and Stuart Birrell of ABE. Projects included advanced harvesting and densification techniques, including the single-pass harvesting projects that baled stalks during the same pass as harvesting corn and other "clean stover" projects.

Large-scale, long-term harvesting and bale storage tests were continued at the BCRF. In a project, 3,000 large square bales of stover were collected from nearly 10,000 acres around central Iowa and transported to the BCRF for storage and testing. Testing was also conducted on the biomass storage potential of bale wrapping, stacking, and ventilated configurations. Work is expected to continue in 2012.

Biomass preparation work was continued and expanded in and around the Biomass Preparation Building in 2011. Phase II of the National Advanced Biofuels Consortium (NABC) project continued to supply single pass stover and other prepared material to several NABC members throughout the United States, including the National Renewable Energy (NREL) and Pacific Northwest National Laboratories (PNNL) of the U.S. Department of Energy (DOE), member universities, and member companies. Many other feedstocks were prepared to their desired size and moisture content as needed. Feedstocks that have been prepared at the BCRF to date are as follows:

- Bagasse
- Corn stover
- Corncobs
- Switchgrass
- Wood chips

Further preparation continued in the area of torrefaction. Construction of a pilot-scale torrefier was completed in 2011. Pilot-scale testing was conducted by Darr throughout 2011 (32 test runs were performed).

Construction of a pilot-scale fractionating pyrolysis unit by Dr. Robert Brown, professor of mechanical engineering, was completed in April 2010. From commissioning to the end of 2011, 46 test runs of various durations were

completed. Week-long, round-the-clock operational testing yielded excellent results on both reliability and bio-oil production. Feedstocks pyrolyzed during 2011 were corn stover and various softwood and hardwood mixtures. The resulting bio-oil and biochar outputs were analyzed and used in various projects, including a bioasphalt mixture used to construct a bike trail at Waveland Park in Des Moines, Iowa.

Construction was completed on a new 0.5 ton per day biomass fluidized-bed gasifier and syngas clean-up system also led by Brown. The unit was commissioned in mid-2011. Shortly after, work began on a joint DOE and Conoco Phillips project investigating new syngas cleanup methods. This work will be completed in 2012.

In 2011, a 1,000-L fermenter and an autoclave were installed in the fermentation area. Several successful fermentations were performed in both the 500-L and 1,000-L fermenters. From their installation until the end of 2011, fermentations were conducted in the areas of fungal fermentation of corn thin stillage from ethanol production to produce swine and poultry feed products, oleaginous yeast fermentations of biodiesel byproducts and cellulosic feedstocks, encapsulation of omega-3 fat acids to improve milk quality, and grain alcohol fermentations. Work was completed for the USDA and other groups. In 2012, a pilot-scale steam drum dryer and a distillation column will be installed to allow the BCRF to produce dried distillers grains with solubles (DDGS) for research purposes.

In 2011, the BCRF completed the following upgrades and acquired new or used equipment:

- Grinding and drying system conveyor belts and control system with instrumentation

- Installation of power to the grinding and drying system
- 140 hp Massey Ferguson tractor
- JCB 527 – 55 telehandler
- 26 in. working height scissors lift
- 6,000 lb capacity fork truck
- Tilt trailer
- Truck scale
- Lab scales
- 1,000 liter fermenter
- Six pine trees for a wind break with support from Dr. Chris Williams (professor of civil, construction, and environmental engineering)

### **Grants and Donations**

From its inception in 2009 through 2011, the BCRF has been well supported with private industry donations. To date, the following companies contributed monetary and in-kind support to Iowa State for use at the BCRF:

- AGCO Corporation
- Centocor, Inc. (Johnson & Johnson)
- Country Landscapes, Inc.
- Crown Iron Works Company
- Deere & Company
- DemoDozer, Inc.
- DuPont Cellulosic Ethanol (DCE)
- Pioneer Hi-Bred International, Inc.
- Rockwell Automation, Inc.
- University of Northern Iowa National Ag-Based Lubricants Center
- Vermeer Corporation

Through these donations, the BCRF has increased its capabilities in biomass harvesting, bulk storage, transport, preparation, fermentation, and production of bio-oil, syngas, and other products. These donations included the construction of three large hoop sheds, grinding and sieving equipment, control systems and software, fermenters and bioreactors, and other ancillary equipment, landscape enhancements, and

unlimited use of several pieces of agricultural and industrial equipment.

The BCRF received a major grant from the Iowa Department of Economic Development (IDED) to purchase research and supporting equipment for use at the building site and surrounding field plots.

### **Visitors**

Information dissemination and promotion was accomplished through tours, conferences, and symposiums. Approximately 150 tours, with approximately 1,100 visitors, were given in 2011. Since the dedication in 2009, the BCRF has hosted 250 tours with 2,850 visitors. Through close cooperation with the Iowa State Research Farms, the Ames Convention and Visitors Bureau, the BioEconomy Institute, and the Iowa State Foundation, many public organizations, private companies, educational organizations, international organizations, and citizens of Iowa have visited the BCRF.