BioCentury Research Farm Launches Redesigned Web Site

The BioCentury Research Farm (BCRF) web site has undergone a significant redesign. The new web site provides easier navigation and more information about BCRF services, facilities, and research activities. Detailed information about the BCRF’s capabilities was also added. Visitors can find descriptions and photos of equipment available for scheduled use.

The partnering section was expanded to include additional information on ways faculty and industry clients can become involved with biorenewables research at the BCRF and Iowa State University. Features include:

- A brief history of the BCRF
- Faculty and staff directories
- An overview of BCRF facilities
- Photo and video galleries
- Guidance for proposal preparation
- Links to BCRF affiliated organizations and Iowa State facilities

Over the next year, the BCRF web site will add social media components such as Twitter and Facebook.

The site can be found at www.biocenturyresearchfarm.iastate.edu.
NSF Invests $20 Million in Renewable Research

Excerpt from Iowa State University News Service article by Dan Kuester

The National Science Foundation has awarded a $20 million, five-year grant to build Iowa’s research capacity in renewable energy and energy efficiency.

The Iowa Power Fund, a state program supporting energy innovation and independence, has also granted the project $2 million to pay for research equipment.

The core of the research project will be conducted at Iowa’s three public universities - Iowa State University, the University of Iowa, and the University of Northern Iowa. The program also includes partnerships with the state’s community colleges, private colleges, school districts, government agencies and industries. Iowa State’s Robert C. Brown - an Anson Marston Distinguished Professor in Engineering, the Gary and Donna Hoover Chair in Mechanical Engineering, and the Iowa Farm Bureau Director of Iowa State’s Bioeconomy Institute - will lead the program. Brown is also an affiliated faculty member of the Center for Crops Utilization Research and BioCentury Research Farm (BCRF).

The research program’s vision is to establish Iowa as a leader in the worldwide transition from fossil fuels to renewable energy sources. The program will be built on four major platforms including the bio-energy platform. This platform will investigate the challenges of sustainably producing large quantities of biomass (such as corn stalks) and using thermo-chemical processes to quickly heat the biomass to produce liquid or gas products suitable for generating electric power or upgrading to transportation fuels. Brown will also lead this platform. The thermo-chemical train in the Biomass Processing Facility at the BCRF will be used for the platform.

The other platforms include the energy policy platform, the wind energy platform, and the energy utilization platform.

Read the article in its entirety here.

Patent Filed for Process to Recycle Polylactic Acid-based Plastic

David Grewell, associate professor of agricultural and biosystems engineering and Center for Crops Utilization Research and BioCentury Research Farm affiliate, applied for a patent for technology associated with recycling polylactic acid-based plastic (PLA).

The technology offers a simple and efficient process for depolymerization or breaking down the disposable PLA into smaller units which can then be used to create renewed plastic material. Current methods to depolymerize PLA are energy intensive and not cost effective.

Grewell and his research team developed a method for post-consumer PLA-based plastic to be recycled in an efficient and economical process. The process uses simple compounds and moderate energy at fast reaction speed to break down the PLA.

Grewell and Iowa State University are seeking industry partners to commercialize this technology.

Contact information for David Grewell
Phone: (515) 294-2036
e-mail: dgrewell@iastate.edu
Research web site
Pilot Plant Update
Hui Wang, Pilot Plant Manager

Jay-lin Jane, Charles F. Curtiss Distinguished Professor of food science and human nutrition and CCUR affiliate, and her research group produced another batch of modified starch in the pilot plant. The starch was partially hydrolyzed before reacting with fatty acid to make it digestion resistant. The treated starch was dewatered, dried, and ground into powder. More information about Jane’s modified starch project can be found in the September-October 2011 newsletter.

Work on the soy skim, a liquid co-product from the enzyme-assisted aqueous extraction of soybeans process, is underway. The large protein molecules were recovered by continuous stack disc centrifuge after isoelectric precipitation. It was neutralized and spray dried into protein powder. The partially de-proteined skim fraction was pasteurized before being treated by a membrane system with a nano-membrane filter to remove large soluble components. The “clarified” water stream will be tested in dry-grind corn ethanol fermentation.

The CEPA high speed tubular centrifuge was employed in an industrial edible fiber project. After enzymatic and physical treatments, the fiber material was washed and dewatered using the semi-continuous tubular centrifuge. The dewatered edible fiber was deposited in the rotating cylinder and once it was filled, the machine was stopped and the material scooped out.

The Alfa Laval stack disc centrifuge was used to treat 1,500 liters of food grade liquid for an industrial client. The objective was to remove a small amount of dispersed fine particles to achieve high clarity. Special connectors/adapters along with...
The BioCentury Research Farm (BCRF) received approximately 20 tons of low ash content corn stover as part of the second phase of the National Advanced Biofuels Consortium (NABC) project. The material was harvested by Stuart Birrell, associate professor of agricultural and biosystems engineering and BCRF affiliate, and his single pass harvesting team. The stover will be ground and shipped to NABC members along with the pine prepared earlier this season. Birrell's team is continuing work on projects with Deere & Company.

The Center for Sustainable Environmental Technologies (CSET) has continued work in pyrolysis, gasification, and high temperature filtration and gas conditioning. CSET successfully made pyrolysis oil from corn stover and other feedstocks over the past year. Work continues with private companies such as Avello Bioenergy, ConocoPhillips, and several others.

The gasifier team is continuing to commission the gasifier and ran it at steady state for an extended duration. Research will begin in earnest in the near future. Bio-oil and biochar analysis and testing are ongoing.

Affiliate professor Matt Darr, assistant professor of agricultural and biosystems engineering, has completed a second year of logistics research in cooperation with DuPont Cellulosic Ethanol. As part of this project, approximately 3,000 corn stover bales have been harvested and received for analysis and long-term storage testing. This work is part of a much larger effort to harvest approximately 10,000 acres of stover. Darr’s group is also continuing work on advanced single pass harvesting practices, and torrefaction and pelletization of stover material. Darr’s group also has projects with Deere & Company and AGCO Corporation.

Affiliate professor David Grewell, associate professor of agricultural and biosystems engineering, is continuing work with his team's composting test equipment.

In a cooperative project of the BioCentury Research Farm and the Agricultural Engineering and Agronomy Research Farms, a new electronic truck scale has been installed at the BCRF. The truck scale is 12 feet by 70 feet and is a drive-on, above ground scale that can handle all semi-trailer trucks, grain trucks, and farm wagons. There are digital displays on each end of the scale and users may enter from either end. There is no charge for university project use. If you have questions, contact Andy Suby, BCRF, (515) 509-6326 or Will Emley, AEA, (515) 290-6283.

The Biomass Processing Facility is currently in the process of upgrading to faster internet/data transfer capabilities and is continuing work on upgrading drying and grinding capabilities.

The BCRF had the following visitors in November and December:

- Bentley Graves (Congressman King’s Office)
- Cathann Kress, vice president for Iowa State University Extension and Outreach
- DuPont
- Frontline
- John Whitaker
- Marion Mixers
- National Robotics Engineering Center
- Nidus Investments
- Pioneer Hi-Bred International
- Rolling Green Elementary School Fifth Grade Renewable Energy Field Trip
- Trakia University, Bulgaria
- United States Department of Agriculture
- USDA International Affairs Specialist to Foreign Ag Students

Left: BioCentury Research Farm workers are using the stationary hammer mill to grind corn stover. Right: Corn stover bale trials are being conducted using hoop structures, under tarps, and without protection.
Researchers Produce Cheap Sugars for Sustainable Biofuel Production

Mike Krapfl, Iowa State University News Service

Iowa State University’s Robert C. Brown keeps a small vial of brown, sweet-smelling liquid on his office table.

“It looks like something you could pour on your pancakes,” he said. “In many respects, it is similar to molasses.”

Brown, in fact, calls it “pyrolytic molasses.” That’s because it was produced by the fast pyrolysis of biomass such as corn stalks or wood chips. Fast pyrolysis involves quickly heating the biomass without oxygen to produce liquid or gas products.

“We think this is a new way to make inexpensive sugars from biomass,” said Brown, an Anson Marston Distinguished Professor in Engineering, the Gary and Donna Hoover Chair in Mechanical Engineering and the Iowa Farm Bureau Director of Iowa State’s Bioeconomy Institute. He is also a Center for Crops Utilization Research (CCUR) and BioCentury Research Farm (BCRF) affiliate.

That’s a big deal because those sugars can be further processed into biofuels. Brown and other Iowa State researchers believe pyrolysis of lignocellulosic biomass has the potential to be the cheapest way to produce biofuels or biorenewable chemicals.

Biopolymers and Biocomposites Research Team Showcase Research at Plastics Conference

The Biopolymers and Biocomposites Research Team (BBRT) exhibited at the Global Plastics Environmental Conference on October 17-19 in Atlanta, Georgia. The team showed samples of plastics and composites made from vegetable oils and proteins, plus flower pots and golf tees manufactured from materials they developed.

David Grewell, associate professor of agricultural and biosystems engineering and chairperson of the BBRT, along with BBRT members Gowrishankar Srinivasan, postdoctoral research associate in agricultural and biosystems engineering, and Keke Chen, graduate student in materials science and engineering, had one-on-one discussions with over 50 individuals from the plastics industry. The booth was visited by over 200 people during the conference.

“We have established long-term relationships with several companies, including NatureWorks, a manufacturer of PLA (bioplastics),” said Grewell.

BBRT members also presented their research with a presentation and student posters. Grewell presented the paper “Effects on Mechanical Properties of Higher Beta Zein Content Bioplastics.” Student members Srinivasan, Chen, and Hongyu Cui, graduate student in materials science and engineering, created posters for the conference.

Their posters can be viewed here. The booth was sponsored by the Center for Crops Utilization Research and the Center for Industrial Research and Service.
Student-Cooperative Team Explores New Feed Manufacturing Business

Higher prices for corn and soybean meal and conversion of pastureland to row crops have cattle feeders exploring new feed options.

A student internship program initiated by Iowa State University to evaluate business opportunities for farmer cooperatives is exploring the feasibility of a new feed business for Farmers Cooperative Company of Afton, Iowa.

“The idea of the business is to replace corn, hay, alfalfa, and soybean meal with cheaper, but nutritionally equivalent, alternative ingredients,” said Jim Schendt, General Manager, Farmers Cooperative – Afton. “The value proposition to cattle producers in southern Iowa and northern Missouri is to become more competitive and have a cost-effective source of feed that extends pastures by 30 to 50 percent.”

The project conducted a preliminary feasibility study for a business manufacturing new, high-value cattle feed from corn stover and agricultural processing byproducts that will permit the cooperative to expand member services, enable cattle feeders in the region to grow their operations, and provide a new market for corn stover produced in the market area.

“The project involved exploration of the technical and financial feasibility of the project, with these efforts being led by three Iowa State interns who worked alongside Farmers Cooperative employees last summer,” said Schendt.

The team made up of three undergraduates – agricultural business student Casey Clemens, animal science student Erika Lundy, and agricultural engineering graduate Nicole Jennett – evaluated the feasibility of a new feed manufacturing business under consideration by Farmers Cooperative – Afton and ADM Alliance Nutrition. Clemens developed the business financial plan, Lundy worked on marketing intelligence and plan development, and Jennett pulled together the work of three student technology design teams.

A senior technology capstone course during spring semester under the leadership of agricultural and biosystems engineering assistant professor Tae Hyun Kim and lecturer Lloyd Snell assigned student teams to project process segments. The three project segments were: 1) delivery and storage through the mixer, 2) pelletizing to final product packaging and storage, and 3) safety for the entire process. This gave students hands-on experience with a real world project.

“The team was successful because Farmers Cooperative employees were happy to take time out of their busy days to provide us with sufficient information to create the feasibility study,” said Clemens. “We also worked very well together and were open to each other’s suggestions.”

The internship was a valuable learning experience for Lundy. “I learned how to manage my time efficiently, work independently as well as a member of a team, and was exposed to how Farmers Cooperative Company operates,” she said.

“Leveraging our resources and those of Iowa State for the creation of a new business in the rural communities we serve has been an exciting development for myself and all those involved in the project,” said Schendt.

Representatives from Farmers Cooperative and ADM Alliance Nutrition are both supportive of developing the plan for this new feed business. Clemens and Lundy expanded the study as Agricultural Entrepreneurship Initiative (AgEI) Semester, Inc. interns this fall. The student design teams also continued their work on the project in their fall semester technology capstone course.

In all, about 20 students were exposed to Farmers Cooperative – Afton’s business, offering the cooperative access to human resources that it needs to remain competitive and educating students about the employment opportunities at cooperatives.

Groundwork has been initiated for a second student internship opportunity at a different Iowa cooperative in 2012.

The program is a joint effort of Iowa State’s AgEI led by Kevin Kimle and the Iowa Alliance for Cooperative Business Development, a USDA cooperative development center managed by Darren Jarboe, Center for Crops Utilization Research.
Iowa State researchers have developed thermochemical technologies that efficiently produce sugars from biomass. In addition to Brown, key contributors to the pyrolysis research at Iowa State include Brent Shanks, the Mike and Jean Steffenson Professor of Chemical and Biological Engineering, director of the National Science Foundation Engineering Research Center for Biorenewable Chemicals based at Iowa State, and CCUR and BCRF affiliate; Christopher Williams, professor of civil, construction and environmental engineering and BCRF affiliate; Zhiyou Wen, associate professor of food science and human nutrition, and CCUR and BCRF affiliate; Laura Jarboe, assistant professor of chemical and biological engineering; Xianglan Bai, adjunct assistant professor of aerospace engineering; Marjorie Rover and Sunita Sadula, research scientists at the Center for Sustainable Environmental Technologies; Dustin Dalluge, a graduate student in mechanical engineering; and Najeeb Kuzhiyil, a former doctoral student who is now working for GE Transportation in Erie, Pennsylvania.

Their work has been supported by the eight-year, $22.5 million ConocoPhillips Biofuels Program at Iowa State. The program was launched in April 2007.

“The Department of Energy has been working for 35 years to get sugar out of biomass,” Brown said. “Most of the focus has been on use of enzymes, which remains extremely expensive. What we’ve developed is a simpler method based on the heating of biomass.”

strict sanitation practices were applied. The liquid was enclosed in the system at all times in order to minimize any microbial contamination.

The small drum dryer was rebuilt, tested, and recently used in a food science and human nutrition teaching course. The main parts of the unit include a pair of 8’x16’ reconditioned drums, a stainless steel frame salvaged from the old unit, two variable frequency motors that drive the drums individually with an rpm of 0-16, and streamlined steam plumbing to supply heat to the drums. The gap between the two drums is also adjustable. The dry product collection pan is detachable and washable. It is designed to dry thick, paste-like materials on a small scale.

Left: Wang is adding sweet potato paste to the drum dryer. Right: The dried sweet potato paste is peeling off the drum dryer and dropping in the collection pan.
De Moura Invited to Teach at Training Program in India

Juliana Nobrega de Moura, postdoctoral research associate for the Center for Crops Utilization Research, was invited as an international expert on membrane filtration and enzyme-assisted aqueous extraction to teach in the training program “Non-thermal, Non-chemical Processing and Membrane Technology in Food Systems” in Bhopal, India, October 12-21. The training was sponsored by the National Agricultural Innovative Project and its purpose was to build national scientific expertise in the area. Twenty-two Indian scientists from different research institutes and universities attended the training, which included theoretical lectures and laboratory demonstrations.

Rosentrater Conducts Training Sessions in Bangladesh

Kurt Rosentrater, assistant professor of agricultural and biosystems engineering and Center for Crops Utilization Research and BioCentury Research Farm affiliate, served as a technical consultant for the John Ogonowski and Doug Bereuter Farmer-to-Farmer for Food Security Program in Bangladesh, September 15-30. The program was sponsored by Winrock International and USAID. Rosentrater conducted hands-on training and process improvement activities at four poultry and aquaculture feed mills throughout the country. He also organized and presented a day-long training seminar “Feed Quality Improvement for Better Aquaculture Practices.” The seminar was attended by approximately 55 feed industry representatives.

Grants


Producing and Characterizing Bacillus Subtilis Biosurfactants with Potentially Lower Environmental Impact for Salt Water Applications, U.S. Environmental Protection Agency - Science To Achieve Results (STAR) Program, $500,000, Buddhi Lamsal, Andy Nyman (Louisiana State University), and P. Somasundaram (Columbia University).