cenusa bioenergy

Quarterly Progress Report

Agro-ecosystem Approach
to Sustainable Biofuels Production via
the Pyrolysis-Biochar Platform

May 2012

Agriculture and Food Research Initiative Competitive Grant
No. 2011-68005-30411

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RE: Quarterly Report, Agro-ecosystem Approach to Sustainable Biofuels Production via the Pyrolysis-Biochar Platform, AFRI-CAP Competitive Grant No. 2011-68005-30411

Dear Mark:

Enclosed is our third quarterly report for the CenUSA Bioenergy Project. As you will find, it has been a very active period for the project. Our extension team has been extremely active with meetings, establishing demonstrations, and publications. The education team has put together an outstanding summer internship program and we look forward to training eleven students across the region this year. As you can imagine it has also been a very active period for our research teams as well. We are in the process of establishing the many field trials that will be the basis of a lot of our research. Some of these have already been planted and all of them should be up and going sometime during the next quarter.

We are very appreciative of your interest and support of the project and look forward to you attending our annual meeting in August. Please feel free to contact us anytime with questions about the project or if we can otherwise be of assistance.

Sincerely,

Ken Moore

Kenneth J. Moore
Charles F. Curtiss Distinguished Professor

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NOTICE

This quarterly report was prepared by Iowa State University and CenUSA Bioenergy research colleagues from Purdue University, United States Department of Agriculture-Agricultural Research Service, University of Illinois, University of Minnesota, University of Nebraska, Lincoln, University of Vermont, and the University of Wisconsin in the course of performing academic research supported by Agriculture and Food Research Initiative Competitive Grant No. 2011-68005-30411 from the United States Department of Agriculture National Institute of Food and Agriculture ("USDA-NIFA).

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Agro-ecosystem Approach to Sustainable Biofuels Production via the Pyrolysis-Biochar Platform (AFRI-CAP 2010-05073)

Quarterly Report: February 1, 2012 – April 30, 2012

PROJECT ADMINISTRATION

1. Project Organization and Governance Accomplishments

CenUSA Bioenergy ("CenUSA") Project Director Ken Moore continues to lead the overall research effort. Chief Operating Officer Anne Kinzel and Business Manager Val Evans continue to handle project administration and business affairs, including all aspects of CenUSA operations, including coordination, communication, and data sharing among institutions across the states. In addition, Kinzel is responsible for the day-to-day project management and the planning and preparation of reports, meetings, data management, and maintenance of the project's public face. Evans is responsible for all project financial activities, including the development and implementation of administrative policies and procedures to ensure effective financial operation and oversight of the project.

a. Project Progress

Each of the nine CenUSA objectives is showing satisfactory progress towards meeting the project's timelines and deliverables schedules.

b. Advisory Board

Advisory Board recruitment was reopened in March when Sarah Alexander was unable to serve on the Board. As Ms. Alexander served as the Board's nonprofit agency representative we wanted to find a replacement who was active in that sector. We were also mindful that we had no board member with a specific interest in local economic development and job creation. With these thoughts in mind, we were able to recruit Ms. Lavon Schiltz to the Board. Ms. Schiltz is the Executive Director of the Nevada Economic Development Council in Nevada, Iowa where she has been successful in recruiting a number of biofuel businesses to central Iowa, including Lincolnway Energy Ethanol and the DuPont Danisco Cellulosic Ethanol facility one of the world's first commercial-scale biorefineries to produce fuel-grade ethanol from cellulose.

c. Coordination, Collaboration, and Communication

- **Executive Team Meetings.** The nine objective leaders continue to meet monthly with Ken Moore, Anne Kinzel and Val Evans via online meetings held in CenUSA's dedicated Adobe Connect meeting room. The virtual meeting room allows for documents to be viewed by all participants, enhancing communications and dialogue between participants. Tom Binder, the Advisory Board chair also attends these

meetings, to ensure there an Advisory Board presence during these important project gatherings.

- **Objective and Team Meetings.** All nine CenUSA Objectives participate in scheduled meetings using the CenUSA Adobe Connect meeting room or in face-to-face meetings.

- **2012 Annual Summit.** The advance planning for the 2012 annual summit is complete. The meeting will be held August 7-9, 2012 in Lincoln, Nebraska (See Appendix for *2012 Annual Meeting Agenda*). Ken Vogel, Supervisory Research Geneticist at the USDA Agricultural Research Service-Northern Plains and leader of the CenUSA Germplasm to Harvest research group**,** will host the 2012 Summit.

- **Communication Platforms.** CenUSA continues to focus on internal and external communication needs. Internally, we continue to refine the "private" side of our website. The goal is for our research team to have a useful repository of information that can be easily shared across objectives.

  We also continue to refine our communications platforms with our external stakeholders (industry professionals, agricultural and horticultural producers, educators, agency personnel, community leaders, extension educators, and the general public). We use our website (www.cenusa.iastate.edu) to broadly disseminate reports, learning modules, articles, and webinars. We also use the website to promote CenUSA events and activities such as educational meetings, webinars, media events, eXtension bioenergy learning modules, field days, and networking opportunities.

  In addition to our website and Twitter account (@CenUSAbioenergy) we have added a YouTube Channel (http://www.youtube.com/user/CenusaBioenergy) to provide an additional outlet to view CenUSA webinars and videos. We are also working on a CenUSA project brochure which should be ready in June 2012.

- **Financial Matters.** The Administrative Team is continuing its work on completing the process of reducing the Project Year 2 budget to meet the funding provided by the USDA-NIFA. Amended subcontracts will be sent to the research partners in May 2012.

- **Program Matters.** We will focus on project coordination, communication, meetings and data sharing across Objectives, and on reaching the revised timelines milestones.

- **Public Events (Administrative Presence).** CenUSA will have a booth at the 2012 Farm Progress Hay Expo in Boone, Iowa (June 20 & 21, 2012).

2. **Annual Summit.** Preparations have been finalized for the 2012 CenUSA Annual Summit. The Summit will be held August 7-9, 2012 in Lincoln, Nebraska. Ken Vogel, who leads the CenUSA **Germplasm to Harvest** research group and who is a Supervisory Research

Geneticist at the USDA Agricultural Research Service (Northern Plains) will host the event, (See Appendix, *2012 Annual Meeting Agenda*).

3. Publications, Presentation, Proposals Submitted

An article titled "*Biofuel Prospects With Prairie Perennials* highlighting the contributions of ARS Scientists and CenUSA CoProject Directors and Collaborators Ken Vogel, Mike Casler, Rob Mitchell, and Akwasi Boateng has been written and reviewed for publication in Agricultural Research, the news magazine of the USDA Agricultural Research Service.

Biorefining Week ran an article on the project titled *Cenusa Project Promotes Regional Advanced Biofuels Development* that was published March 30, 2012.

Biofuels Digest published an article titled *Cenusa lands $25M USDA grant to develop big bluestem, Indian grass and switchgrass for biofuels* on March 26, 2012.

BioFuels Journal interviewed Project Director Ken Moore for an article titled "*Feedstocks Drop-in Grasses*" that will appear in the second quarter issue of the 2012 publication.

A subcommittee continues to work on the CenUSA 2012 Farm Bill white paper. A draft of the paper is in circulation and it is anticipated that it will be released in June.2012. Moore is drafting a presentation and paper for the 3rd Pan American Congress of Plants and Bioenergy that will be held in Champaign, Illinois July 15-18, 2012.

GERMPLASM TO HARVEST

Objective 1. Feedstock Development

Feedstock Development focuses on developing perennial grass cultivars and hybrids that can be used on marginal cropland in the Central United States for the production of biomass for energy. In 2012, the focus is on the establishment of new breeding and evaluation trials.

1. Planned Activities

- Obtain seed of check cultivars for use in trials, complete all seed testing, finalize plans, and distribute seed to all cooperators.
- Complete specific cooperative agreements with cooperators as needed.
- Complete staffing and training new employees for field season.
- Establish seedlings for genetics studies in greenhouse for field transplanting in June 2012.

2. Actual Accomplishments

- Seed of all check cultivars and experimental strains obtained, packaged, and shipped to yield trial cooperators. There are separate switchgrass, big bluestem, and indiangrass trials. Included in the trials are 22 switchgrass entries (seven cultivars and 15 experimental strains), 12 big bluestem entries (seven cultivars and five experimental strains), and 12 indiangrass entries (six cultivars and six experimental strains). Trials will be planted at 12 locations in the region with the potential seeding of another trial. Trial locations and cooperators are listed in Table 1. The Ravenna, Nebraska Location is tentative.
- Specific cooperative agreements with cooperators are in the final approval process.
- Staffing has been completed and new employees have been trained for the field season.
- Genetics and breeding nurseries have been established in greenhouse for transplanting into field nurseries in late spring.
- Project plant pathologists and entomologists have been briefed on the breeding program, and received information on field nurseries. We are ready to begin experiment monitoring.

3. Explanation of Variance

No variance has been experienced and accomplishments are on schedule.

4. Plans for Next Quarter

- Switchgrass, big bluestem, and indiangrass yield tests planted at all locations.
- Switchgrass, big bluestem, and indiangrass selection nurseries and breeder seed increase nurseries transplanted to field nurseries.
- Stand and survival notes taken on all switchgrass selection nurseries established in 2011. Heading and other noted completed.
- Nurseries monitored for plant pathogens and insects.
- Switchgrass, big bluestem, and indiangrass sample sets assembled for analyses by CenUSA Collaborators Bruce Dien and for initial pyrolysis work by Akwasi Boateng.

5. Publications, Presentations, and Proposals Submitted

Kenneth P. Vogel, “Biomass Biofuel Policy, Switchgrass Genetics, and Next Generation Bioenergy Varieties” (Training session to a switchgrass workshop at the University of Nebraska’s Agricultural Research and Development Center near Ithaca, Nebraska, March 20, 2012). Vogel also gave a training session on conversion technologies at a

workshop/professional development field day for extension educators, state agencies, federal agencies, and others. Presentation was video taped for future webinars by University of Nebraska and Iowa State University staff.

Objective 2. Sustainable Feedstock Production Systems

Objective 2 focuses on conducting comparative analyses of the productivity potential and the environmental impacts of the most promising perennial grass bioenergy crops and management systems using a network of 14 fields strategically located across the Central United States. The overarching goal is to produce a quantitative assessment of the net energy balance of candidate systems and to optimize perennial feedstock production and ecosystem services on marginally productive cropland while maintaining food production on prime land. In Project Year 1 this team will focus will be on establishment of new test plots.

1. Planned Activities

- Finalize plans and protocols for new plots that need to be established under Objective 2.
- Purchase inputs for plot establishment in the 2012-growing season.
- Weather permitting we will acquire baseline soil cores from plots.

2. Actual Accomplishments

Design and implementation plans for the Factor Analysis experiments were finalized and distributed to all Co-Project Directors. Briefly, the objective of the Factor Analysis (FA) plots is to establish small plots of location-specific candidate feedstocks on marginally productive land to evaluate feedstock yield and quality, and develop and improve best management practices (BMPs). The FA plots will be seeded in Illinois, Indiana, Iowa, Minnesota, Nebraska, and Wisconsin to evaluate the economic feasibility of establishment, best management practices and yield potential of available and candidate feedstocks.

- **Feedstocks**: Each site will have three standard feedstocks and at least two location-specific feedstocks. Treatments will be replicated four times. A cropping history of the field will be needed; especially information on yield of maize, soybean or other grain crops species to serve as an indicator of site productivity.
  - ✓ F1 = ‘Shawnee’ switchgrass
  - ✓ F2 = bioenergy switchgrass
  - ✓ F3 = low diversity mixture (big bluestem, indiangrass and sideoats grama)
  - ✓ F4 = location-specific candidate feedstock 1

- ✓ F5 = location-specific candidate feedstock 2

- Candidate feedstocks that may be considered for study:
  - ✓ High diversity prairie mixture (10 species)
  - ✓ Miscanthus
  - ✓ Prairie cordgrass
  - ✓ Local ecotypes
  - ✓ Others as justified by the PIs and approved by Objective 2 leaders
- Plots will be fertilized beginning in Project Year 2 with 3 N rates. Other N, P, and K rates may be used if they will better inform the BMPs for species at this location:
  - ✓ N1 = 0 lbs actual N/acre
  - ✓ N2 = 50 lbs actual N/acre
  - ✓ N3 = 100 lbs actual N/acre
- Inputs are being purchased as needed for planting and growing season research activities. Seed for the FA plots has been distributed to all FA and the Extension Demonstration sites from the ARS unit in Lincoln, Nebraska.
- Soil sampling is underway and planting has started at some locations, weather permitting.
- Planned, identified site and staked out new factor analysis plots in Iowa. On ongoing baseline soil profile analysis work this quarter included: pH, Mehlich 3, EC, and CEC extractions of bulk surface soils from system plots.
- Systems Analysis plots were seeded in Nebraska.

3. Explanation of Variance

No variance has been experienced and accomplishments are on schedule.

4. Plans for Next Quarter

- **Seed Factor Analysis Plots.** Monitor establishment and weed competition, and use control measures as necessary.
- Continue to analyze soil samples.
- Initiate 2012 research on the Systems Analysis plots in Indiana, Iowa, and Nebraska. Seed perennial Systems Analysis Plots in Iowa. Seed annual systems, fertilize, apply

weed control measures, and other agronomic practices as necessary. Where possible, install necessary equipment and begin environmental measurements, including greenhouse gas measures.

5. Publications, Presentations, and Proposals Submitted

Jeffrey J. Volenec and Sylvie M. Brouder. "Nutrient Use in Bioenergy Cropping Systems" (Presentation to Plant Growth, Nutrition and Environment Interactions Conference, University of Veterinary Medicine, Vienna, Austria, February 18 – 21, 2012.

Objective 3. Feedstock Logistics

Objective 3 focuses on developing systems and strategies to enable sustainable and economic harvests, transportation and storage of feedstocks that meet agribusiness needs. The team also investigates novel harvest and transport systems and evaluates harvest and supply chain costs as well as technologies for efficient deconstruction and drying of feedstocks.

1. Planned Activities

One activity was planned during the spring harvest period – a replication of the fall-study concerning quantification of energy requirements for harvest and size-reduction using forage harvesters and balers.

2. Actual Accomplishments

Two studies were completed. The first study was undertaken to quantify the energy required to harvest switchgrass and reed canarygrass using a forage harvester. The forage harvester was configured to harvest at four different theoretical-lengths-of-cut (TLC): 5, 1, 17 and 22 mm. Moisture content was very low with all material below 15% (w.b.). Average post-harvest particle-size (as quantified by ASABE Standard S424.1) was much less than the TLC for all but the 5 mm TLC. The crop was so dry and brittle that the mechanical action of chopping and conveyance produced much greater size-reduction than would have been expected with the cutterhead alone. Specific fuel use ranged from 1.8 to 2.8 L/Mg DM, which was a roughly 20% reduction from the fall harvested material at greater moisture content.

A silo bag of the dry, chopped grasses was formed to conserves the chopped material. Bag density was 150 kg DM/ft3, about 70% of the density of a large-square bale. Bagging required approximately 0.9 L/Mg DM, so total fuel required for harvesting and compaction was 2.7 to 3.7 L/Mg DM.

Another study was undertaken to quantify the energy required to harvest switchgrass and reed canarygrass using a round baler equipped with a pre-cutter. The pre-cutter is used to size-reduce the crop prior to densification in the bale chamber. The baler was configured to pre-cut at a TLC of 70 and 140 mm. A control without pre-cutting was also used. All material

was less than 15% (w.b.) moisture. Harvesting rate ranged between 19 and 25 Mg DM/h. Fuel use ranged between 0.7 and 0.9 L/Mg DM. There was no significant difference in fuel per unit mass between the two crops, but there was a pre-cutting with a full complement of knives increased baler PTO power by 30% and fuel use by 20%. Pre-cutting a full complement of knives increased bale density by 9%.

Across both the baling and chopping studies, switchgrass yield was 20% less in the spring than the fall. Reed canarygrass yield was only 4% less, but the spring yield was artificially inflated because the very warm early spring weather created considerable regrowth in the standing crop.

3. **Explanation of Variance**

   There were no variances – we have accomplished all that we had planned for the spring harvest.

4. **Plans for Next Quarter**

   We will be conducting an additional study that quantifies the energy required to size-reduce the reed canarygrass and switchgrass bales made last fall and also this spring. Comparisons will be made with the total energy required to harvest and size-reduce bales to that required to harvest and size-reduce with the forage harvester. Design work on the systems to improve the transport logistics of chopped material will begin in this quarter. We are also identifying other land area currently in perennial grass production for additional tests.

5. **Publications, Presentations, and Proposals Submitted**

   None to report this period.

Objective 4. System Performance Metrics, Data Collection, Modeling, Analysis and Tools

Objective 4 focuses on providing detailed analyses of feedstock production options and an accompanying set of spatial models to enhance the ability of policymakers, farmers, and the bioenergy industry to make informed decisions about which bioenergy feedstocks to grow, where to produce them, what environmental impacts they will have, and how biomass production systems are likely to respond to and contribute to climate change or other environmental shifts.

1. **Planned Activities**

   The first two broad tasks under Objective 4 are to adapt existing biophysical models to best represent field trials and other data and to adapt existing economic land-use models to best represent cropping system production costs and returns.

2. Actual Accomplishments

We have acquired and are testing the most recent version of the Environmental Policy Impact Climate (EPIC) model. The model is a field-scale environmental model that can be used for estimating soil erosion losses, nitrogen and phosphorus movement, and soil carbon sequestration. An improved version of EPIC0810 is adopted here to account for emission estimates of two important greenhouse gases: nitrous oxide gas and N_2 (dinitrogen gas). This version of EPIC operates with daily climatic inputs, but the denitrification computations are performed on an hourly time step using inputs from the soil organic submodel. This version of EPIC also contains the improved soil carbon cycling functions developed by Izaurralde et al. (2006).

We completed the draft of a policy brief that provides an assessment of the potential for cellulosic feedstocks to reduce the frequency and magnitude of flood events in the Raccoon River Watershed in Iowa. We use a watershed based hydrologic model to represent changes in water movement under different land uses in the watershed. First, we develop a baseline scenario of flood risk based on the current land use and typical weather patterns. We then simulate the effects of varying levels of increased perennials on the landscape under the same weather patterns and compare the change in stream flows and water quality to the baseline scenario. A manuscript based on this paper is now completed and under review at a journal.

We have been developing scenarios for land-use change associated with production of dedicated herbaceous bioenergy crops on the Midwest landscape. We have completed a draft of a manuscript in which we compare projections of biomass amounts and sources from USDA, DOE, and US-EPA. We demonstrate that the large variation in switchgrass availability on a state-by-state basis is largely dependent upon assumptions related to the use of Conservation Reserve Program (CRP) land and the likelihood of converting pastureland to bioenergy production. We are also developing county-level enterprise budgets for switchgrass production to generate in-house supply curves for comparison. To accomplish this, we are evaluating extant field trials and preparing estimates of reasonably expected future gains in yield.

We have also begun harmonizing the procedure for data handoff between the InVEST (Integrated Valuation of Environmental Services and Tradeoffs) and the Agro-IBIS (Integrated Biosphere Simulator) modeling platforms. For a test case, we are using baseline and 2020-projected maps developed by the Future Midwestern Landscapes Study at the Ecosystem Services Research Program at EPA. To accomplish this, we have begun reclassifying vegetation and reprojecting maps covering our modeling domain.

3. Explanation of Variance

No variance has been experienced and accomplishments are on schedule.

4. Plans for Next Quarter

We will continue work on the first two tasks: 1) To adapt existing biophysical models to best represent field trials and other data and 2) To adapt existing economic land-use models to best represent cropping system production costs and returns.

5. Publications, Presentations, and Proposals Submitted

- Catherine L. Kling, "Markets and Regulation: Alternative or Complements?" (Presentation to the USDA 2012 Agricultural Outlook Forum, Washington DC, February 23, 2012, http://www.card.iastate.edu/environment/presentations.aspx).
- Catherine L. Kling, Jimena González-Ramírez and Adriana Valcu "An Overview of Carbon Offsets from Agriculture" forthcoming at the Annual Review of Resource Economics Vol. 4, October 2012 www.annualreviews.org.proxy.lib.iastate.edu:2048/doi/abs/10.1146/annurev-resource-083110-120016
- Jason Hill, "Advanced Life Cycle Impact Assessment of Agricultural Products" (Presentation to USDA/NIFA program directors and staff, Washington, DC, April 17, 2012).
- Jason Hill, "Advanced Life Cycle Assessment of Alternative Bioenergy Futures" (Invited presentation from the Natural Resource Ecology and Management Graduate Program, Iowa State University, Ames, Iowa, February 17, 2012).

POST-HARVEST

Objective 5. Feedstock Conversion and Refining: Thermo-chemical Conversion of Biomass to Bio-fuels

Objective 5 will perform a detailed economic analysis of the performance of a refinery based on pyrolytic processing of biomass into liquid fuels and will provide biochar to other CenUSA researchers. The team concentrates on two primary goals:

- Estimating energy efficiency, GHG emissions, capital costs, and operating costs of the proposed biomass-to-biofuels conversion system using technoeconomic analysis; and
- Preparing and characterizing Biochar for agronomics evaluations.

1. Planned Activities

The focus for this project objective includes identification of differences between responses of pyrolysis products produced from different switchgrass germplasms undergoing catalytic and non-catalytic pyrolysis.

This will be conducted by looking at the differences between the germplasms (i.e. growth conditions, composition, type of plant) that may result in differences in pyrolysis products produced by using various analytical techniques such as py-GCMS and elemental analysis. Also looking at the effect H-ZSM-5 catalyst has on the products produced and their ability to remove significant differences within feedstocks. Resulting information will be used to investigate different catalytic pathways from the feedstock (i.e. lignin, cellulose, hemicellose) to de-oxygenated compounds that were not found in abundance in non-catalytic pyrolysis.

2. Actual Accomplishments

- We carried out standard calibration curves for 28 condensable gas (CG) compounds produced via fast pyrolysis and eight non-condensable gases (NCG) in a py-GCMS at 500°C.
- We received 12 germplasm samples of switchgrass with two biological repeats of each from Dr. Vogel's Objective 1 group at ARS Lincoln, Nebraska.
- We ran the 24 samples through the py-GCMS with three repeats of each sample at 500°C following the standard (1) and quantified the pyrolysis oil products and the NCG for both catalytic and non-catalytic pyrolysis.
- We conducted statistical analysis on the differences between germplasms and the differences between products in catalytic and non-catalytic pyrolysis.
- We quantified the CHNO ratios in the germplasm biomass using elemental analysis
- We estimated the High Heating Values for each germplasm using the wt% of the pyrolysis CG via calculations.
- Anion exchange capacities of 18 biochars were determined by ion chromatography.
- Surface areas of 18 biochars were determined by BET-N2 adsorption method.

3. Explanation of Variance

No variance has been experienced and accomplishments are on schedule.

4. Plans for Next Quarter

- To complete char yield quantification of the samples received from Lincoln using py-GCMS.
- To carry out overall mass balance of the CG (determined by py-GCMS), NCG, char and CG not detected by py-GCMS by difference.
- Carry out statistical analysis for char and NCG between germplasms and catalytic and non-catalytic pyrolysis.

- Expect to receive information gathered from the germplasm growers including the structure of the cell walls composition and type of feedstock.
- Do statistical analysis to compare biomass composition to products produced via fast pyrolysis.
- Determine different reaction pathways that occur in pyrolysis based on germplasm composition and result in a difference in pyrolysis products.
- Write a publication.
- Expect to receive a larger pool of samples and complete larger scale experiments based off the methods used in this project.
- Use of a microwave pyrolyser to obtain bio-oil, char and gas to be analyzed.
- Use FTIR to analyze functional group chemistry of biochars.

5. Publications, Presentations, and Proposals Submitted

None to report this period.

Objective 6 Markets and Distribution

Objective 6 recognizes that a comprehensive strategy that addresses the impacts to and requirements of markets and distribution systems will be critical to the successful implementation and commercialization of a regional biofuels system derived from perennial grasses grown on land unsuitable or marginal for the production of row crops. To create this comprehensive strategy the team focuses on two unifying approaches:

- The study and evaluation of farm level adoption decisions, exploring the effectiveness of policy, market and contract mechanisms that facilitate broad scale voluntary adoption by farmers; and
- Estimate threshold returns that make feasible biomass production for biofuels.

1. Planned Activities

With a technical definition for marginal land forthcoming, our team planned to begin with a baseline assumption that certain lands in CRP are candidates for switch grass biomass production. CRP data (rents, acres, parcel characteristics) can be utilized to begin to develop cost estimates of switchgrass production on CRP lands and develop the comparisons to corn production. With the production and cost estimates our team plans to advance CenUSA Objective 6 CoProject Director Dermot Hayes' research to estimate the

necessary carbon subsidy needed to induce switchgrass production on those lands over corn production.

2. Actual Accomplishments

- Our team is composing a proposal to the USDA to gain access to CRP data from recent general and continuous signups. These data include parcel-specific information on a type of marginal land that may be used in the project's system. Such parcel-specific information will be used to develop expectations of switchgrass biomass cost estimates, yields, and expected production penalty of switchgrass relative to competing crops. Our team anticipates a delay of several months before these data will be available to us, if the USDA is able to make them available.

- CenUSA Collaborator Richard Perrin is collecting switchgrass trial data from states relevant to our study. We expect this will continue into the next quarter.

- Hayes and CenUSA Objective 6 CoProject Director Keri Jacobs began preparing for an undergraduate research intern for summer 2012.

3. Explanation of Variance

No variance has been experienced and accomplishments are on schedule.

4. Plans for Next Quarter

Our Objective's goal for the next quarter is to begin to assess and formalize in a way that is informative and useful to the CenUSA project as a whole the "barriers and drivers of implementation" of the biomass production system. In order to do this, the pieces that need to come together are those that are currently being undertaken. Perrin will continue collection of switchgrass trial data and the proposal to the USDA to obtain recent CRP offers data will be submitted. If the USDA indicates that are unable to provide such data, we will reformulate and likely rely on aggregated CRP data that are publicly available, but that provide less information about land's characteristics and its expected yields and costs.

One piece critical to our success is a formal definition of marginal lands that will be considered in our biomass production system. Our team will work with other CenUSA Objectives to secure a working definition.

As part of our commitment to the project's education component, Hayes and Jacobs will finalize a research agenda for the Iowa State University undergraduate research intern this summer.

5. Publications, Presentations, and Proposals Submitted

None.

Objective 7 Health & Safety

The production of bioenergy feedstocks will have inherent differences from current agricultural processes. These differences could increase the potential for workforce injury or death if not properly understood and if effective protective counter measures are not in place.

The Objective 7 team addresses two key elements in the biofuel feedstock supply chain:

- The risks associated with producing feedstocks; and
- The risks of air/dust exposure.

1. Task 1 – Managing Risks in Producing Feedstocks

a. Planned Activities

The team continued the collection/definition process for identifying the various duties/responsibilities associated with producing feedstocks to be used in risk assessments for hazards.

b. Actual Accomplishments

The major duties/responsibilities have been preliminarily identified. A safety instruction publication was developed for Extension and Outreach activity for Broader Public Education/Master Gardener Program to assist volunteer gardeners in the Master Gardner's program about the safety precautions when handling, applying, and storing of biochar.

c. Explanation of Variance

No variance has been experienced and accomplishments are on schedule.

d. Plans for Next Quarter

Additions to the preliminarily identified listing of duties and responsibilities will occur and refinement and details will begin to be added to this listing.

e. Publications, Presentations, and Proposals Submitted

Charles V. Schwab and Mark Hanna. 2012. Master Gardeners' safety precautions for handling, applying, and storing biochar. CenUSA Bioenergy publication. ISU University Extension and Outreach, Ames, IA 50011(See Appendix, *Master Gardeners' Safety Precautions for Handling, Applying and Storing Biochar*).

2. Task 2 – Assessing Primary Dust Exposure

a. Planned Activities

This activity is scheduled during Project Year 2 but initial locations where dust exposures are possible are being identified from Task 1, above.

b. Actual Accomplishments

Not applicable.

c. Explanation of Variance

Not applicable.

d. Plans for Next Quarter

We will continue to identify any potential locations of dust exposure while producing the listing of duties and responsibilities associated with producing feedstocks.

e. Publications, Presentations, and Proposals Submitted

None to report this period.

OUTREACH AND EXTENSION

Objective 8 Education

Objective 8 seeks to meet the future workforce demands of the emerging Bioeconomy through two distinct subtasks, as follow:

- To develop a shared bioenergy curriculum core for the Central Region, and
- To provide interdisciplinary training and engagement opportunities for undergraduate and graduate students.

Subtask 1 is curriculum development. Subtask 2A involves training undergraduate students via an 8-week summer internship program modeled on the highly successful NSF REU (research experience for undergraduates) program.

Subtask 2B involves training graduate students via a 2-week summer intensive program modeled on a highly successful industry sponsored intensive program in biorenewables the team led in 2009.

Subtask 1: Curriculum Development

1. Planned Activities

- Hire a staff member to coordinate the module development program.
- Complete the conversion of first module into interactive, web-based format.

- Complete content outlines of three additional modules, including:
  - ✓ Perennial Grass Establishment and Fertility Management.
  - ✓ Storage Systems for Bioenergy Grasses.
  - ✓ Harvesting System for Bioenergy Grasses.

2. Actual Accomplishments

- Staff member and consultant to assist with module development program have been hired.
- The first module "Perennial Grass Physiology, Growth and Development" is complete.
- Content outlines of the following modules have been partially completed:
  - ✓ Harvesting Systems for Bioenergy Grasses.
  - ✓ Storage Systems for Bioenergy Grasses.
  - ✓ Logistics Modeling of Feedstock Production Systems: Field to Factory.
  - ✓ Perennial Grass Establishment and Fertility Management.

3. Explanation of Variance

The student working on the feedstock logistics modules arrived five weeks later to Purdue University than anticipated and was unable to complete content outlines for the three feedstock logistics modules within the third quarter. These content outlines will be completed in the fourth quarter.

4. Plans for Next Quarter

- Determine the topics for the remaining 10 modules.
- Complete content outlines and begin conversion to web-based format for the following modules:
  - ✓ Harvesting system for bioenergy grasses.
  - ✓ Storage systems for bioenergy grasses.
  - ✓ Logistics Modeling of Feedstock Production Systems: Field to Factory.
  - ✓ Perennial Grass Establishment and Fertility Management.
- Complete draft content outlines for two modules in the markets & distribution area.

5. Publications, Presentations, and Proposals Submitted

None to report this period.

Subtask 2A: Training Undergraduates via Internship Program

1. Planned Activities

- Continue to promote the undergraduate internship program and encourage application submissions through the March 30 application deadline.
- Centrally vet and rank applicants based on letter of interest, academic achievement, previous research experience, and letters of recommendation.
- Pool of likely candidates given to faculty hosts for review on April 5, 2012, with selection decisions made by April 9, 2012.
- First offers to students on April 10, 2012, second offers to students on April 16 with cohort (12 students) finalized on April 20, 2012.

2. Actual Accomplishments

- Vigorous promotion of the program yielded a pool of highly qualified applicants by the March 30 application deadline.
- Central vetting and ranking of applications was completed on April 2-4, 2012.
- Pool of likely candidates given to faculty hosts for review on April 6, 2012 with selection decisions made on April 11, 2012.
- First offers made on April 13, second offers made on April 20 with cohort (11 students) finalized on April 30, 2012.

3. Explanation of Variance

The student selection process by faculty took slightly longer than anticipated. This delayed the timing of offers; however the finalization of the cohort was only delayed 10 days beyond what was originally planned. Travel and accommodation costs are slightly higher than originally anticipated, therefore we are holding at 11 interns (of the 12 budgeted).

4. Plans for Next Quarter

- Finalize all internship logistics (student travel, lodging, and stipend payment methods to partners).
- Provide mentor training using 15-minute video (created by Raj Raman). The video will be shared via link with the internship student mentors (grad student/postdoc) in mid-May

2012, followed by a combined face-to-face (for ISU-based mentors) and virtual (via Adobe Connect for partners) meeting to clarify any questions.

- Launch program – Orientation will take place at Iowa State University. Students will be sent to their labs. Schedule meetings (June 20 – August 1) with student interns to discuss progress, face-to-face for Iowa State University students and virtual (via Adobe Connect) for partner-placed students.

5. Publications, Presentations, and Proposals Submitted

None to report this period.

Subtask 2B – Training Graduate Students via Intensive Program

1. Planned Activities

None. This is a Project Year 2 activity, and forward planning will begin in summer 2012.

2. Actual Accomplishments

Not applicable.

3. Explanation of Variance

Not applicable.

4. Plans for Next Quarter

Not applicable.

5. Publications, Presentations, and Proposals Submitted

None to report this period.

Objective 9 Extension and Outreach

Objective 9 serves as CenUSA's link to the larger community of agricultural and horticultural producers and to the public-at-large. The team delivers science-based knowledge and informal education programs linked to CenUSA Objectives 1-7.

The following teams conduct the Outreach and Extension Objective's work:

- **Extension Staff Training/eXtension Team**

  This team concentrates on creating and promoting professional development activities for Extension educators and agricultural and horticultural industry leaders.

- **Producer Research Plots/Perennial Grass Team**

This team covers the areas of:

- ✓ Production, harvest, storage, transportation.
- ✓ Social and community impacts.
- ✓ Producer and general public awareness of perennial crops and Biochar agriculture.
- ✓ Certified Crop Advisor training.

- **Economics and Decision Tools Team**

  This team will focus on the development of crop enterprise decision support tools to analyze the economic possibilities associated with converting acreage from existing conventional crops to energy biomass feedstock crops.

- **Health and Safety Team**

  This team integrates its work with the Producer Research Plots/Perennial Grass and the Public Awareness/Horticulture/eXtension 4-H and Youth teams (See Objective 7).

- **Public Awareness/Horticulture/eXtension 4-H and Youth Team**

  This team focuses on two separate areas:

  - **Youth Development** – The emphasis is on developing a series of experiential programs for youth that introduce the topics of biofuels production, carbon and nutrient cycling.
  - **Broader Public Education/Master Gardener Program** – The goal is to acquaint the non-farm community with biofuels and biochar through a series of outreach activities using the highly successful Master Gardener volunteer model as the means of introducing the topics to the public.

- **Evaluation/Administration Team**

  This team coordinates CenUSA's extensive extension and outreach activities. The team is also charged with developing evaluation mechanisms for assessing learning and behavior change resulting from extension and outreach activities, compiling evaluation results and preparing reports, and coordination of team meetings.

1. Extension Staff Training/eXtension Team

a. Planned Activities

- Host a "Switchgrass Establishment" field day at the USDA's Agricultural Research and Development Center ARDC in Mead, Nebraska (March 20, 2012.)

- Film Switchgrass Establishment field day activities and create videos and webinars from recorded activities:

  ✓ Finish harvest video by June 15, 2012.

  ✓ Film "Planting Demonstration Video (Due to bad weather shooting was delayed from March 20 Switchgrass Establishment Field Day and was rescheduled to April 24, 2012. Shooting was completed on April 24, 2012, and the first round of editing has been completed. Work continues on the script and the entire project should be complete by June 15, 2012. Distribute video to CenUSA website and YouTube Channel.

  ✓ Create enhanced Drill Planter Calibration Demonstration video from additional footage.

  ✓ Finish Module 1 for Objective 8 – Education (John Guretzky) by June 15, 2012 and begin Module 2.

- Help coordinate webinar and video distribution with the CenUSA Administrative Team.

b. Actual Accomplishments

- **Switchgrass Establishment Field Day and Webinars.** The University of Nebraska-Lincoln hosted the Switchgrass Establishment Field Day in Mead, Nebraska on March 20, 2012. ~~Twenty-five persons~~ attended onsite and another 20 attended via live video streaming. The event was advertised through the University of Nebraska-Lincoln's Plant and Soil Sciences eLibrary (http://passel.unl.edu/pages/), and it's CropWatch Bioenergy (http://cropwatch.unl.edu/) website, the Ag Energy eXtension website (http://www.eXtension.org/ag_energy), CenUSA (www.cenusa@iastate.edu) website, the University of Nebraska Agronomy and Horticulture Department, and other media outlets (See Appendix, *Switchgrass Establishment Field Day* poster). 30 attended

  The program consisted of five presentations and one demonstration:

  ✓ **Switchgrass and Perennial Grasses, Biomass and Biofuels**
  Ken Vogel, CenUSA Bioenergy Germplasm to Harvest Group Leader

  ✓ **Switchgrass Establishment, Weed Control and Seed Quality**
  Rob Mitchell, CenUSA Bioenergy Objective 2 – Sustainable Feedstock Production Systems, CoProject Director

  ✓ **Switchgrass and Bioenergy Logistics**
  Stuart Birrell, CenUSA Bioenergy Objective 3 – Logistics, CoProject Director.

  ✓ **Switchgrass: Cost of Production**
  Marty Schmer, Agrosystems Management Research Unit, USDA-ARS

- ✓ **Industry Perspectives**
  David Stock, CenUSA Bioenergy Advisory Board

- ✓ **No Till Drill Seeder Calibration Demonstration**
  Rob Mitchell, CenUSA Bioenergy Objective 2 – Sustainable Feedstock Production Systems, CoProject Director

Archived videos of the presentations are available on the CenUSA website (www.cenusa@iastate.edu) and at the CenUSA YouTube channel (http://www.youtube.com/user/CenusaBioenergy).

- **Switchgrass Harvest and Bailing video.** The University of Nebraska-Lincoln campus technology center was not able to finish the video on schedule due to unforeseen personnel changes. We selected outside vendor, Three Pillars Media to complete the project. A script has been recorded and video footage edited. The draft video is currently under review by CenUSA collaborators for final editing suggestions.

- **Planting Demonstration Video.** Due to bad weather, shooting for this video was rescheduled from March 20, 2012 to April 24, 2012. Shooting was completed on April 24, 2012, and the first round of editing is complete. Work continues on the script and the entire project should be complete by June 15, 2012.

- **Planter Calibration Demonstration video.** Raw footage was captured at the March 20, 2012 Switchgrass Establishment Field Day. The draft video is currently under review by CenUSA collaborators John Hay, John Guretzky, and Patrick Murphy.

- **Review Protocol Developed.** The team will be using a newly developed form to record and organize peer review of online extension/education pieces. The form is accessible through "Google Docs."[1]

- **Project Management.** The team has adopted online project management platform "Smart Sheets" to help manage the team deliverables schedule.

c. Explanation of Variance

- To be able to maintain the video and webinar deliverable schedule the team had to engage an outside video producer (Three Pillars Media). The team is now fully staffed and functioning superbly.

- The team has been able to revise the deliverables upward. Originally, the team was scheduled to produce two webinars in Year 1, with a total runtime of two hours.

[1] See https://docs.google.com/spreadsheet/viewform?formkey=dHg4M0dhc3dXOXdjWUY4S0VKVnY5OGc6MQ#gid=0

However, the March 20, 2012 Field Day provided the team with the opportunity to produce webinars for all five presentations with a total runtime of over four hours. The team has completed its Year webinar production goal.

d. Plans for Next Quarter

- **Complete Additional Videos**

  Complete the video peer-review process, add closed captioning and post to the CenUSA website and the CenUSA YouTube channel three additional videos:

  ✓ Switchgrass Harvest Video.

  ✓ Planter Calibration Demonstration Video.

  ✓ Planting Video.

e. Publications, Presentations, and Proposals Submitted

None to report this period.

2. Producer Research Plots/Perennial Grass Team

a. Planned Activities

- Finalize protocols for establishing field plots. (See Appendix, Plot Protocols)
- Host training session for cooperating producers and Extension educators on establishing native warm season grasses.
- Procure and distribute seed lots to project personnel in each state.
- Identify needs for Extension materials for cooperating producers and future field days.

b. Actual Accomplishments

- **A Switchgrass Establishment Field Day and Webinars**. The Field Day was held in Mead, Nebraska on March 20, 2012, and hosted by the University of Nebraska-Lincoln. Twenty-five persons attended onsite and 20 attended via live video streaming. The event was advertised through the University of Nebraska-Lincoln's Plant and Soil Sciences eLibrary (http://passel.unl.edu/pages/), and it's CropWatch Bioenergy (http://cropwatch.unl.edu/) website, eXtension, CenUSA (www.cenusa@iastate.edu) website, the University of Nebraska Agronomy and Horticulture Department, and others (See Appendix, *Switchgrass Establishment Field* Day poster).

- An alternative cooperating producer and a new field site for Project Year 1 plots were identified in Iowa.
- Plot layouts and establishment protocols were finalized.
- The "Switchgrass Establishment Field Day" was held on March 20, 2012 (See above).
- Personnel in CenUSA Objectives 1 and 2 distributed seed lots to each state.
- An initial list of Extension publication needs was identified. Tentative titles are:
  - ✓ Establishment of native warm season grasses for bioenergy production.
  - ✓ Growth and fertility management of native warm season grasses for bioenergy production.
  - ✓ Harvest management of native warm season grasses for bioenergy production.
- Planting and pre-emergent herbicide application was completed at the Humboldt, Nebraska field site in on April 26, 2012.

c. Explanation of Variance

The initial field site in Iowa (Blakesburg) was part of a larger field that is being enrolled in the Conservation Reserve Program. Due to time limitations and procedural difficulties in obtaining a variance from the Farm Service Agency to use the site for research activities, an alternative producer and site was identified. Phil Winborn is the new Iowa cooperating producer and the field site is located near Kalona, Iowa. Due to warmer weather and drier field conditions the field site in Nebraska was planted and pre-emergent herbicides applied early than expected. Neither change will negatively impact the project.

d. Plans for Next Quarter

- Plant and apply pre-emergent herbicides on field sites in Iowa, Indiana and Minnesota.
- Finalize field scouting and reporting protocols and have cooperating producers begin implementation.
- Complete draft of Extension publication "*Establishment of native warm season grasses for bioenergy production*."
- Develop reporting procedures and assessment tool for Project outreach activities.

e. Publications, Presentations, and Proposals Submitted

- The "Switchgrass Establishment Field Day" was held on March 20, 2012 in Mead, Nebraska (See above).
- CenUSA Collaborator Dr. Keith Johnson gave a presentation about the CenUSA project at the Biomass Energy Working Group (IBEWG) meeting held in Jasper, Indiana on March 8, 2012. The presentation's goal was designed to engage local producers in the education and demonstration of bioenergy crop production in the local area.
- CenUSA Collaborator Chad Martin gave a presentation about renewable energy including bioenergy crop utilization at the Wabash County (Iowa) Rural Electric Municipal Cooperative on March 12, 2012.

3. Economics and Decision Tools Team

a. Planned Activities

Provide CenUSA awareness presentations to agricultural audiences.

b. Actual Accomplishments

- *Sustainable Production and Distribution of Bioenergy for the Central USA*. Presented for "Iowa Learning Farm", Ames, Iowa, February, 2012 (Recording available at https://connect.extension.iastate.edu/p12zpjc19pr/?launcher=false&fcsContent=true&pbMode=normal).
- These webcasts were broadcast live from the March 20, 2012 *Switchgrass Establishment Field Day* (Mead, Nebraska):
  - ✓ **"Sustainable Production and Distribution of Bioenergy for the Central USA."** https://connect.extension.iastate.edu/p12zpjc19pr/?launcher=false&fcsContent=true&pbMode=normal (Presented at the 41st Annual Cornbelt Cow-Calf Conference, Ottumwa, Iowa, January 21, 2012.
    - Approximately 50 participants (including Iowa Secretary of Agriculture Bill Northey).
- "**Biomass Crop Production Workshop."** This workshop was held March 8, 2012, in Creston, Iowa. CenUSA Farm Management Specialists facilitated roundtable discussions regarding what it would take for farmers to plant perennials on environmentally sensitive lands. Data from the roundtables is still being tabulated.

c. Explanation of Variance

No variance has been experienced and accomplishments are on schedule.

d. Plans for Next Quarter

No planned activity is scheduled in in Project Years 1 and 2. The Team is available to assist other Objectives and Teams as needed throughout the first two project years.

e. Publications, Presentations, and Proposals Submitted

None to report this period.

4. Health and Safety

a. Planned Activities

See Objective 7, above.

b. Actual Accomplishments

Public Awareness/Horticulture/eXtension 4-H and Youth Team to publish a Biochar Safety Sheet) (See attached).

c. Explanation of Variance

No variance has been experienced and accomplishments are on schedule.

d. Plans for Next Quarter

Additions to the preliminarily identified listing of duties and responsibilities will occur and refinement and details will begin to be added to this listing. See Objective 7, above.

e. Publications, Presentations, and Proposals Submitted

Charles V. Schwab and Mark Hanna. 2012. Master Gardeners' safety precautions for handling, applying, and storing biochar. CenUSA Bioenergy publication. ISU University Extension and Outreach, Ames, IA 50011.

5. Public Awareness/Horticulture/eXtension 4-H and Youth Team

3.A – Youth Development

a. Youth Development – Planned Activities

- Continue developing materials and plans for Indiana summer youth science workshops.

b. Youth Development – Actual Accomplishments

- The Purdue University CenUSA Youth team met to continue discussion of project objectives and tasks for PY 1 and 2. Team communication via email and phone is ongoing.
- The Youth team has participated in overall Purdue CenUSA team meetings and planning activities.
- A Purdue University graduate student is developing fact sheets. Topics currently under development are biomass production, biochar utilization, biofuels, and carbon and nutrient cycling.
- The CenUSA Extension faculty is collaborating with Purdue CenUSA team members on the utilization of research and extension plots for education and outreach. Plots at Throckmorton Research Farm will be utilized in the high school youth summer science workshops in June 2012. The Team will be collaborating with CenUSA CoProject Director Patrick Murphy and CenUSA Collaborator Keith Johnson.
- High school youth will plant grasses to take home during the June 2012 Indiana science workshop.
- High school youth will participate in additional activity TBD during the June 2012 Indiana science workshop.
- The Purdue CenUSA extension team continued meeting with the Purdue Agriculture Exhibit Design Center to plan tabletop portable display for various uses such as producer meetings, the Indiana State Fair, and Extension meetings and conferences.

c. Youth Development – Explanation of Variance

No variance has been experienced and accomplishments are on schedule.

d. Youth Development – Plans for Next Quarter

Finalize Indiana workshop plans and materials and host Indiana youth science workshop.

e. Youth Development – Publications, Presentations, and Proposals Submitted

None to report this period.

3.B – Broader Public education/Master Gardener Program

a. Broader Public Education/Master Gardener Program – Planned Activities

- Provide CenUSA developed educational resources to Master Gardeners (MG), Junior Master Gardener (JMG) Leaders, and other community educators through local and state continuing education opportunities, such as State Master Gardener Conference and JMG training.
- Conduct assessments to measure youth and adult demonstration plot results and learning outcomes using online and electronic assessment.
- Develop supporting educational materials for educating Master Gardener volunteers, teaching materials for the volunteers to use, and social media for engaging Master Gardener volunteers. Post materials on-line.
- Master Gardener Community Volunteers and local Master Gardener county agents and volunteers will recruit additional Master Gardeners
- Collect names and email address of participants in events and online activities.
- Conduct assessment of knowledge gained and behavior changes

b. Broader Public Education/Master Gardener Program – Actual Accomplishments

- Biochar safety sheet has been completed. (See Appendix). Materials that will be used as talking points for Master Gardener volunteers are being created.
- Assessments will be performed after the Master Gardener volunteer training scheduled for June 2012.
- Educational materials are being developed for Master Gardeners for the June 2012 training. These materials will encompass general information about the CenUSA grant, information about pyrolysis and biochar, as well as directions for collecting data at the research site. This information will be shared between Minnesota and Iowa Master Gardeners.
- Thirty-seven Master Gardener volunteers have been recruited in Minnesota and 25 have been recruited in Iowa. Site leaders for each site have been selected and have met to review their project.
- No assessments have been implemented to date, but are scheduled for completion during the summer of 2012.
- **Garden Design Completed.** Soil tests have been conducted, including measurement of organic carbon levels. The sites have been flagged and sprayed to kill existing vegetation. Tilling, application and planting dates have been set.

- Tools and plants have been purchased and started, and logistical issues at each site have been addressed.
- Royal Oak Industries (ROI) biochar has been ordered. ROI is donating the materials to CenUSA with CenUSA responsible for shipping costs.

c. Broader Public Education/Master Gardener Program – Explanation of Variance

- Minnesota site changes:
  - ✓ The Arboretum site was moved from the picnic shelter area due to construction. The new location is on 3-Mile Drive near the dahlia and winterberry trial beds. Water, parking, restrooms are available. This site will still be easily accessible by visitors and will be part of Arboretum's 2012 "Dirt-O-Rama" exhibition about soil (June 2- October 14, 2012, See Appendix, *Dirt-O-Rama* poster and http://www.arboretum.umn.edu/DirtORamaThisSummer.aspx).
  - ✓ The site at the University of Minnesota Research and Outreach Center in Rosemount, Minnesota (RROC) was relocated to the University of Minnesota Extension Regional Center in Andover, Minnesota. The Extension Regional Center is located in the Bunker Hills Regional Park managed by the Anoka County Parks. This change was due to unforeseen gravel mining operations at RROC set to start in fall 2012 which will result in moving the entire horticulture education garden and research plots.
  - ✓ Assessments will be performed after the Master Gardener training in June 2012. More assessments will be developed once gardens are established and when there are opportunities for public outreach regarding the biochar project.

d. Broader Public Education/Master Gardener Program – Plans for Next Quarter

- Establish initial Master Gardener biochar demonstration gardens. All sites are on schedule for planting.
- Establish initial biochar demonstration gardens and plot signage.
- Master Gardener Community Volunteers will coordinate planting demonstration sites.
- Project staff and faculty will make presentations at the 2012 Upper Midwest Master Gardener Conference (Chanhassen, Minnesota July 19-21, 2012).
- The Minnesota Arboretum exhibition will be underway (See Appendix, *Is Biochar a Good Amendment for Your Soil?*).
- A CenUSA Extension Master Gardener Team meeting is scheduled for July 22-23, 2012 in Minneapolis, Minnesota.

- Coordinate demonstration sites. Expand social media. Develop a "Learning Package" for Master Gardeners and teachers to use for educational program. Build connections to the National Junior Master Gardener program and Extension Master Gardeners.
- Develop supporting educational materials for educating Master Gardener volunteers, teaching materials for the Master Gardener volunteers to use, and social media for engaging Master Gardeners (MG) volunteers; post on-line. Complete teaching materials for Master Gardener to use for educational programs.
- Conduct assessments to measure youth and adult outputs and outcomes using online and electronic assessment tools. Develop and complete online and electronic assessment tools to measure youth and adult outputs and outcomes.
- Collect names and email address of participants all events and online activities.
- Conduct assessment of knowledge gained and behavior changes.
- CenUSA Collaborator Julie Weisenhorn is scheduled to make presentations at the 2012 Minnesota State Fair in the Horticulture Building at "The Dirt" stage.
- 2012 Upper Midwest Master Gardener Conference at the Minnesota Landscape Arboretum will feature a presentation on the project by CenUSA Lynne Hagen as well as and possible involvement by University of Minnesota faculty/CenUSA Collaborators.
- Extension and Outreach Objective Collaborators will meet July 22-23 at the Minnesota Landscape Arboretum to prepare their draft section for the 2012 Annual Report and to prepare for the CenUSA Annual Meeting in Lincoln, Nebraska in August 2012.
- Minnesota's role in the project will be featured in the fall 2012 issue of *Solutions* a publication by the University of Minnesota College of Food, Agriculture, and Natural Resource Sciences (CFANS).

e. Broader Public Education/Master Gardener Program – Publications, Presentations, and Proposals Submitted

- CenUSA Master Gardener Site design (See Appendix, *CenUSA Extension Master Gardener Plot Design*).
- CenUSA Master Gardener Plant list (See Appendix, *CenUSA Extension Master Gardener Plant List*).
- Minnesota sign design for Dirt-O-Rama event (See Appendix, *Dirt-O-Rama* poster).

6. Evaluation/ Administration Team

a. Evaluation/ Administration Team – Planned Activities

- Develop template for use in evaluation of all CenUSA Extension and Outreach activities.
- Tabulate and summarize evaluations from CenUSA Extension and Outreach activities.

b. Evaluation/ Administration Team – Actual Accomplishments

- An evaluation template has been developed for all CenUSA Extension and Outreach activities and is in final formatting stage.
- Evaluations from two Extension and Outreach biochar presentations have been completed.
- Evaluation from Biomass Production Workshop has been completed (See Appendix, *Biomass Crop Evaluation – March 8, 2012*).
- Summary of Roundtable Discussions from Biomass Production Workshop is being prepared.
- CenUSA Extension and Outreach Co-Project Director Jill Euken attends all Extension and Outreach Team meetings (most teams meet monthly) to facilitate linkages between all Extension and Outreach Teams and between the teams and the research faculty working on CenUSA Objectives 1-8.

c. Evaluation/ Administration Team – Explanation of Variance

No variance has been experienced and accomplishments are on schedule.

d. Evaluation/ Administration Team – Plans for Next Quarter

The team will continue to provide evaluation services and administrative support.

e. Evaluation/ Administration Team – Publications, Presentations, and Proposals Submitted

CenUSA Extension and Outreach Co-Project Director Jill Euken provided an overview of the CenUSA project to an Extension educators training event held in Columbia, Missouri on April 10, 2012.

Working Agenda for the CenUSA Annual Summit
(Lincoln, NE, August 7-9, 2012)

Date	Time	Agenda Item	Location
Aug. 7	0730-0900	Open meeting, review agenda, introductions. (Continental Breakfast @ 7:30)	Lincoln Downtown Holiday Inn
	0900-0915	Load bus or buses for research tour	UNL Ag. Res. Dev. Ctr. (ARDC)
	1000-1200	Research tour of Obj. 1 & Obj. 2 (Feedstock development and management)	
	1200-1300	Catered lunch with discussion of ARDC research	
	1300-1500	ARDC tour cont. Report & discussion – Objectives 1, 2, 7, & 8.	
	1500-1600	Return to Lincoln	
	1600-1800	Year 1 Accomplishment reports - Non Lincoln Obj. 1 & 2, Obj. 3 & 4.	Lincoln Downtown Holiday Inn
	1830-2030	Group dinner (At local restaurant)	
August 8			
	0730-0800	USDA- NIFA comments (Continental Breakfast @ 7:30)	Lincoln Downtown Holiday Inn
	0800-0945	Report & discussion – Objectives 5 & 6	
	0945-1015	Break	
	1015-1230	Report & discussion – Objectives 7 8 & 9	
	1230-1330	Lunch break – At hotel.	
	1330-1430	Advisory Board – Questions & Comments	
	1430-1445	Break (Refreshments)	
	1445-1800	Year 2 Planning by Objective and Objective integration.	
	Free evening	Many restaurants in area (>25 within easy walking distance).	Local restaurants
August 9			
	0730-1000	Year 2 Planning by Objective and Objective integration. (Continental Breakfast @ 7:30)	Lincoln Downtown Holiday Inn
	1000-1015	Break	
	1015-1200	Continue planning including Administrative planning	
	1200	**Adjourn**.	
	1300-xxxx	Individual team meetings as arranged.	

Master Gardeners' safety precautions for handling, applying, and storing biochar

Biochar is a fairly common label used to identify the by-product from the gasification of carbonaceous materials like wood chips or grasses. It is a solid odorless powder that has a gray/black or black/tan color depending on the process and original carbonaceous material. This by-product has some characteristics that require safety precautions while storing, handling, and applying.

Handing and Applying Biochar

The personal safety concerns for biochar are potential irritations to your skin, eyes, and respiratory system. The exposure to airborne biochar dust may cause irritation. The body's reaction could be immediate or delayed. To help minimize the potential irritation exposure, Master Gardeners should follow some safety practices of applying biochar and use specified personal protective equipment when needed.

Biochar Safe Practices

A safety goal of handling and applying biochar is to minimize the amount of biochar that is suspended in the air. Use caution when transferring biochar from package to soil or package to applicator. Avoid dumping biochar out of the package from a height. Consider postponing applications when the wind creates conditions that can easily suspend biochar. If using an applicator, staying upwind during transfer of biochar into the applicator may reduce personal exposure. These practices prevent the formation of a biochar dust cloud and limit potential exposure biochar.

Personal Protective Equipment

Personal protective equipment recommended for Master Gardeners while handling or applying biochar would be eye protection, gloves, long sleeves, long pants, and respirator depending on the conditions. The level of protection depends upon the amount of biochar dust suspended in the air and quantity of biochar that could be suspended. The minimum eye protection recommended is safety glasses but if the environment is laden with biochar dust then non-vented goggles are recommended. In the case of eye exposures, treat biochar dust in eyes as a foreign object and flush with water for 15 minutes, including under the lids to remove any dust particles.

Hazards to Watch

- Avoid biochar dust contact with skin
- Do not inhale biochar dust
- Avoid biochar dust contact with eyes
- Do not ingest biochar

Precautions to Take

- Keep biochar dust to a minimum
- Wear safety glasses
- Wear gloves
- Wear long sleeve shirts
- Consider respirator if needed
- Follow rules for safe storage

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| April 2012

Gloves

Most Master Gardeners already use gloves while working so this is no different. However if conditions are such that the biochar is or becomes wet then typical cloth, canvas, or leather gloves may not be sufficient, so in these wet conditions latex or PVC gloves are recommended. Gloves and long sleeves are a barrier to prevent dust from contacting the skin. Consideration should be given to using disposable outer garments if the work environment is extremely dusty with biochar. It is important to wash all exposed skin with soap and water. Launder all clothing before reuse or discard disposable outer garment after use.

Respirators

Avoid breathing biochar dust. In small applications of biochar and when precautions are taken to avoid suspending biochar then no respirator is required. If conditions are such that you cannot avoid breathing dust, you experience discomfort with any level of biochar dust, or have respiratory problems then the use of an NIOSH-Approved N95 particulate filtering face piece respirator should be used. Use of respirator requires proper fitting and checking with your physician before using.

Biochar Storage

Never store near food and beverages. Biochar should be stored in a cool, dry place away from direct sunlight. It is important to reseal containers immediately after use. Freshly produced Biochar may be prone for auto ignition and spontaneous heating when exposed to air. Consider the volume of biochar being stored and location of your storage site knowing the potential for auto ignition. Large quantities of of stacked biochar have more potential of spontaneous flame when exposed to air.

Finely ground biochar powder suspended in the air in a closed container has the potential to become a fuel if an ignition source is present. If leftover biochar is re-packaged, avoid using tightly sealed rigid containers such as cans or jars, but consider using a bag so that flexible sides and be rolled up leaving little opportunity for dust to become airborne inside the container during transportation or other handling.

For more information

This project is supported by Agriculture and Food Research Initiative Competitive Grant No. 2011-68005-30411 from the National Institute of Food and Agriculture.

This flier was written by Charles V. Schwab, ISU professor and extension safety specialist and Mark Hanna, ISU Extension Agricultural Engineer.

Read and view more information, newsletters, education modules, training videos, and field trials from the Cenusa Bioenergy project website at:

http://www.cenusa.iastate.edu/

cenusa bioenergy

Cenusa Bioenergy project is an ambitious Iowa State University-based, USDA sponsored, research project investigating the creation of a Midwestern sustainable biofuels system. A network of nine institutions are investigating a regional system for producing fuels from feedstocks derived from potentially high biomass producing herbaceous perennials using the pyrolytic conversion process. The research teams concentrate activities on nine separate objectives:

Objective 1.

Feedstock Development

Objective 2.

Sustainable Feedstock Production Systems

Objective 3.

Logistics

Objective 4.

System Performance Metrics, Data Collection, Modeling, Analysis, and Tools

Objective 5.

Feedstock Conversion/Refining

Objective 6.

Markets and Distribution

Objective 7.

Health and Safety

Objective 8.

Education

Objective 9.

Extension and Outreach

This document was prepared by Patrick Murphy for the Cenusa Bioenergy Obj. 9 Producer Research Plots/Perennial Grass Team and distributed to the Team on April 4, 2012. For questions contact Patrick Murphy ptmurphy@purdue.edu

Protocols

Establishing demonstration plots is critical for producer acceptance of the field-scale production of bioenergy feedstocks. Our objective is to establish 2-acre demonstration sites on CRP-type land in IN, IA, MN and NE to demonstrate rapid and economically feasible establishment, best management practices, yield potential of available feedstocks, and differences between forage and bioenergy switchgrass strains. Each site will be seeded to monocultures of 'Shawnee' switchgrass, bioenergy switchgrass, and a low diversity mixture (big bluestem, indiangrass, sideoats grama). Location will determine cultivar selection. Plots of other feedstocks (i.e., Miscanthus, high diversity mixture) may be established. Crop history and historic corn/soybean yield will help characterize the site. Fertilizer strips will be applied in Year 2.

Seeding

All seed will be provided (except additional feedstocks) and seeded using standard protocols. If grass seeding equipment is lacking in your area, ARS-Lincoln has a Truax no-till drill available for use. A "train the trainer" field day was held to demonstrate drill calibration, seeding methods, seed quality tests, stand frequency of occurrence evaluation, and prescribed burning. Frequency grids and protocols will be provided to estimate stand frequency of occurrence in seeded areas.

Switchgrass Establishment

- No-till seed into soybean stubble or clean till and pack to leave a faint footprint
- Plant 2 to 3 weeks either side of optimum corn planting date
- Use high quality certified seed of Shawnee and bioenergy switchgrass
- Plant 30 PLS ft^{-2} 1/4 to 1/2 inch deep with a no-till drill
- Manage weeds with a pre-emergent application of 1 quart of atrazine plus 8 ozs. of quinclorac (Paramount®) per acre
- Control broadleaf weeds by mowing in July and/or spraying with 1-2 quarts of 2,4-D

Big bluestem, Indiangrass, and sideouts grama Establishment

- No-till seed into soybean stubble or clean till and pack to leave a faint footprint
- Plant 2 to 3 weeks either side of optimum corn planting date
- Use high quality certified seed
- Plant 30 PLS ft-2 1/4 to 1/2 inch deep with a no-till drill with a chaffy seed box
- Manage weeds with a pre-emergent application of 4 ozs. of imazapic (Plateau®) per acre
- Control broadleaf weeds by mowing in July and/or spraying with 1-2 quarts of 2,4-D

CenUSA Bioenergy: This project is supported by Agriculture and Food Research Initiative Competitive Grant no. 2011-68005-30411 from the USDA National Institute of Food and Agriculture.

Sampling and Harvesting

Sample each feedstock from at least three locations for biomass and feedstock quality. At each location, standing crop biomass will be estimated by clipping a 0.3-m x 3.66-m quadrat to a 10-cm stubble height and visual obstruction. An additional 500-g feedstock quality sample will be collected by clipping to a 10-cm stubble height and placing in a 1-bushel paper bag. For each biomass and quality sample, determine wet weight, dry for at least 48 hours at 55^{o}C to a constant weight, determine dry weight, grind to pass a 2-mm screen in a Wiley mill, store in urine specimen containers and ship to Nebraska. Plots will be harvested individually with available field-scale equipment, baled in large round or large square bales, and stored at the field edge.

Additional Field Notes

- Individual plots should 3,000 to 3,800 sq. ft. in area.
- A minimum of a 10 ft. grassed alleyways should be planted around the perimeter of all blocks. Consider seeding wider alleyways where adjacent to other crops, particularly soybeans, to reduce the potential for damage due to spray drift.

Soil sampling

Soil samples should be taken prior to planting in year 1 according to according to procedures in your state. 8" soil cores should be taken in IN and 6" soil cores in Iowa (Minnesota?, Nebraska?) P and K should be maintained at "optimum" levels based on recommendations for corn production at a yield goal of 125-150(?) bu per acre. P and K will be applied at the time of nitrogen (urea) application starting in year 2.

Post-planting, pre-emergent herbicide mixes:

- Switchgrass: 8 oz. of Paramount® per acre + 1 lb. atrazine per acre + 1.5 pt. methylated seed oil (MSO) per acre applied at 20 gal per acre
- Indiangrass, Bluestem, Sideoats Grama: 4 ozs. of Plateau® per acre + 1% v/v methylated seed oil (MSO) applied at 20 gal per acre

IOWA 2012

Block 1 Species Randomized

Upland switchgrass w/ herbicide (60 lb N/acre)
Upland switchgrass w/o herbicide (60 lb N/acre)
Low-diversity mix w/herbicide (60 lb N/acre)
Low-diversity mix w/o herbicide (60 lb N/acre)
Bioenergy switchgrass w/ herbicide (0 lb N/acre)
Bioenergy switchgrass w/ herbicide (30 lb N/acre)
Bioenergy switchgrass w/ herbicide (60 lb N/acre)
Bioenergy switchgrass w/o herbicide (60 lb N/acre)
Bioenergy switchgrass w/ herbicide (90 lb N/acre)
Bioenergy switchgrass w/ herbicide (120 lb N/acre)

Block 2 All Treatments Randomized

Bioenergy switchgrass w/o herbicide (60 lb N/acre)
Low-diversity mix w/o herbicide (60 lb N/acre)
Upland switchgrass w/o herbicide (60 lb N/acre)
Bioenergy switchgrass w/ herbicide (120 lb N/acre)
Upland switchgrass w/ herbicide (60 lb N/acre)
Bioenergy switchgrass w/ herbicide (60 lb N/acre)
Bioenergy switchgrass w/ herbicide (0 lb N/acre)
Bioenergy switchgrass w/ herbicide (90 lb N/acre)
Bioenergy switchgrass w/ herbicide (30 lb N/acre)
Low-diversity mix w/herbicide (60 lb N/acre)

INDIANA 2012

Block 1 Species Randomized

Low-diversity mix w/herbicide (60 lb N/acre)
Low-diversity mix w/o herbicide (60 lb N/acre)
Upland switchgrass w/ herbicide (60 lb N/acre)
Upland switchgrass w/o herbicide (60 lb N/acre)
Bioenergy switchgrass w/ herbicide (0 lb N/acre)
Bioenergy switchgrass w/ herbicide (30 lb N/acre)
Bioenergy switchgrass w/ herbicide (60 lb N/acre)
Bioenergy switchgrass w/o herbicide (60 lb N/acre)
Bioenergy switchgrass w/ herbicide (90 lb N/acre)
Bioenergy switchgrass w/ herbicide (120 lb N/acre)

Block 2 All Treatments Randomized

Low-diversity mix w/herbicide (60 lb N/acre)
Bioenergy switchgrass w/ herbicide (90 lb N/acre)
Low-diversity mix w/o herbicide (60 lb N/acre)
Bioenergy switchgrass w/o herbicide (60 lb N/acre)
Upland switchgrass w/o herbicide (60 lb N/acre)
Bioenergy switchgrass w/ herbicide (120 lb N/acre)
Bioenergy switchgrass w/ herbicide (0 lb N/acre)
Bioenergy switchgrass w/ herbicide (30 lb N/acre)
Upland switchgrass w/ herbicide (60 lb N/acre)
Bioenergy switchgrass w/ herbicide (60 lb N/acre)

MINNESOTA 2012

Block 1 Species Randomized

Bioenergy switchgrass w/ herbicide (0 lb N/acre)
Bioenergy switchgrass w/ herbicide (30 lb N/acre)
Bioenergy switchgrass w/ herbicide (60 lb N/acre)
Bioenergy switchgrass w/o herbicide (60 lb N/acre)
Bioenergy switchgrass w/ herbicide (90 lb N/acre)
Bioenergy switchgrass w/ herbicide (120 lb N/acre)
Upland switchgrass w/ herbicide (60 lb N/acre)
Upland switchgrass w/o herbicide (60 lb N/acre)
Low-diversity mix w/herbicide (60 lb N/acre)
Low-diversity mix w/o herbicide (60 lb N/acre)

Block 2 All Treatments Randomized

Bioenergy switchgrass w/ herbicide (120 lb N/acre)
Low-diversity mix w/o herbicide (60 lb N/acre)
Upland switchgrass w/ herbicide (60 lb N/acre)
Upland switchgrass w/o herbicide (60 lb N/acre)
Bioenergy switchgrass w/ herbicide (30 lb N/acre)
Bioenergy switchgrass w/ herbicide (60 lb N/acre)
Bioenergy switchgrass w/ herbicide (90 lb N/acre)
Bioenergy switchgrass w/ herbicide (0 lb N/acre)
Bioenergy switchgrass w/o herbicide (60 lb N/acre)
Low-diversity mix w/herbicide (60 lb N/acre)

TPAC INDIANA 2012

Block 1 Species Randomized

Upland switchgrass w/ herbicide (60 lb N/acre)
Upland switchgrass w/o herbicide (60 lb N/acre)
Bioenergy switchgrass w/ herbicide (0 lb N/acre)
Bioenergy switchgrass w/ herbicide (30 lb N/acre)
Bioenergy switchgrass w/ herbicide (60 lb N/acre)
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Bioenergy switchgrass w/ herbicide (90 lb N/acre)
Bioenergy switchgrass w/ herbicide (120 lb N/acre)
Low-diversity mix w/herbicide (60 lb N/acre)
Low-diversity mix w/o herbicide (60 lb N/acre)

Block 2 All Treatments Randomized

Bioenergy switchgrass w/o herbicide (60 lb N/acre)
Low-diversity mix w/herbicide (60 lb N/acre)
Upland switchgrass w/o herbicide (60 lb N/acre)
Upland switchgrass w/ herbicide (60 lb N/acre)
Bioenergy switchgrass w/ herbicide (120 lb N/acre)
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Bioenergy switchgrass w/ herbicide (60 lb N/acre)
Bioenergy switchgrass w/ herbicide (0 lb N/acre)
Bioenergy switchgrass w/ herbicide (30 lb N/acre)
Bioenergy switchgrass w/ herbicide (90 lb N/acre)

Block 3 All Treatments Randomized

Bioenergy switchgrass w/ herbicide (30 lb N/acre)
Upland switchgrass w/o herbicide (60 lb N/acre)
Bioenergy switchgrass w/ herbicide (60 lb N/acre)
Bioenergy switchgrass w/ herbicide (90 lb N/acre)
Bioenergy switchgrass w/o herbicide (60 lb N/acre)
Bioenergy switchgrass w/ herbicide (120 lb N/acre)
Low-diversity mix w/herbicide (60 lb N/acre)
Low-diversity mix w/o herbicide (60 lb N/acre)
Upland switchgrass w/ herbicide (60 lb N/acre)
Bioenergy switchgrass w/ herbicide (0 lb N/acre)

Block 4 All Treatments Randomized

Low-diversity mix w/herbicide (60 lb N/acre)
Bioenergy switchgrass w/ herbicide (90 lb N/acre)
Bioenergy switchgrass w/ herbicide (0 lb N/acre)
Bioenergy switchgrass w/ herbicide (120 lb N/acre)
Low-diversity mix w/o herbicide (60 lb N/acre)
Upland switchgrass w/o herbicide (60 lb N/acre)
Upland switchgrass w/ herbicide (60 lb N/acre)
Bioenergy switchgrass w/ herbicide (30 lb N/acre)
Bioenergy switchgrass w/ herbicide (60 lb N/acre)
Bioenergy switchgrass w/o herbicide (60 lb N/acre)

IOWA 2013

Block 1 Species Randomized

Low-diversity mix w/herbicide (60 lb N/acre)
Low-diversity mix w/o herbicide (60 lb N/acre)
Bioenergy switchgrass w/ herbicide (0 lb N/acre)
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Bioenergy switchgrass w/ herbicide (60 lb N/acre)
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Bioenergy switchgrass w/ herbicide (90 lb N/acre)
Bioenergy switchgrass w/ herbicide (120 lb N/acre)
Upland switchgrass w/ herbicide (60 lb N/acre)
Upland switchgrass w/o herbicide (60 lb N/acre)

Block 2 All Treatments Randomized

Low-diversity mix w/herbicide (60 lb N/acre)
Bioenergy switchgrass w/o herbicide (60 lb N/acre)
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Bioenergy switchgrass w/ herbicide (120 lb N/acre)
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Upland switchgrass w/ herbicide (60 lb N/acre)
Bioenergy switchgrass w/ herbicide (90 lb N/acre)
Bioenergy switchgrass w/ herbicide (60 lb N/acre)
Bioenergy switchgrass w/ herbicide (30 lb N/acre)

INDIANA 2013

Block 1 Species Randomized

Upland switchgrass w/ herbicide (60 lb N/acre)
Upland switchgrass w/o herbicide (60 lb N/acre)
Bioenergy switchgrass w/ herbicide (0 lb N/acre)
Bioenergy switchgrass w/ herbicide (30 lb N/acre)
Bioenergy switchgrass w/ herbicide (60 lb N/acre)
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Bioenergy switchgrass w/ herbicide (90 lb N/acre)
Bioenergy switchgrass w/ herbicide (120 lb N/acre)
Low-diversity mix w/herbicide (60 lb N/acre)
Low-diversity mix w/o herbicide (60 lb N/acre)

Block 2 All Treatments Randomized

Low-diversity mix w/o herbicide (60 lb N/acre)
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Bioenergy switchgrass w/ herbicide (120 lb N/acre)
Bioenergy switchgrass w/o herbicide (60 lb N/acre)
Bioenergy switchgrass w/ herbicide (0 lb N/acre)
Upland switchgrass w/ herbicide (60 lb N/acre)
Bioenergy switchgrass w/ herbicide (90 lb N/acre)
Low-diversity mix w/herbicide (60 lb N/acre)
Bioenergy switchgrass w/ herbicide (60 lb N/acre)

MINNESOTA 2013

Block 1 Species Randomized	Upland switchgrass w/ herbicide (60 lb N/acre)
	Upland switchgrass w/o herbicide (60 lb N/acre)
	Bioenergy switchgrass w/ herbicide (0 lb N/acre)
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	Low-diversity mix w/herbicide (60 lb N/acre)
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Block 2 All Treatments Randomized	Upland switchgrass w/ herbicide (60 lb N/acre)
	Bioenergy switchgrass w/ herbicide (90 lb N/acre)
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	Low-diversity mix w/herbicide (60 lb N/acre)
	Low-diversity mix w/o herbicide (60 lb N/acre)
	Bioenergy switchgrass w/o herbicide (60 lb N/acre)
	Bioenergy switchgrass w/ herbicide (60 lb N/acre)

NEBRASKA 2013

Block 1 Species Randomized

Bioenergy switchgrass w/ herbicide (0 lb N/acre)
Bioenergy switchgrass w/ herbicide (30 lb N/acre)
Bioenergy switchgrass w/ herbicide (60 lb N/acre)
Bioenergy switchgrass w/o herbicide (60 lb N/acre)
Bioenergy switchgrass w/ herbicide (90 lb N/acre)
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Upland switchgrass w/o herbicide (60 lb N/acre)
Low-diversity mix w/herbicide (60 lb N/acre)
Low-diversity mix w/o herbicide (60 lb N/acre)

Block 2 All Treatments Randomized

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Bioenergy switchgrass w/ herbicide (60 lb N/acre)
Low-diversity mix w/herbicide (60 lb N/acre)
Bioenergy switchgrass w/o herbicide (60 lb N/acre)
Upland switchgrass w/o herbicide (60 lb N/acre)

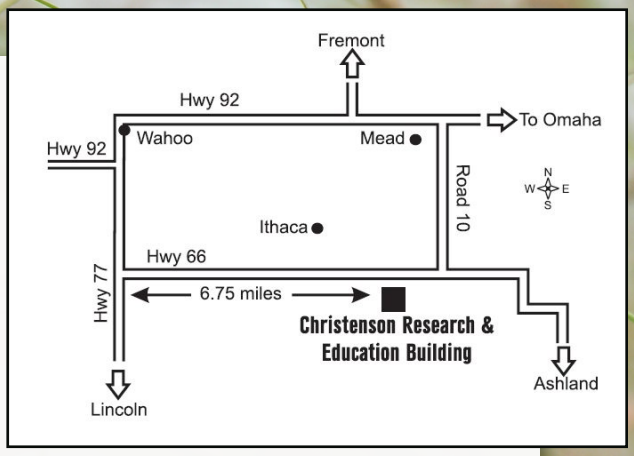
cenusa bioenergy

University of Nebraska Lincoln EXTENSION

Know how. Know now.

Switchgrass Establishment Mar. 20, 2012

Professional development field day for Extension Educators, State Agencies, NRDs, NRCS, and others.
Focus: Establishment and production of switchgrass for biomass and bioenergy.
Registration is free : Supported by a multi-state USDA CenUSA bioenergy grant. https://www.cenusa.iastate.edu/



Location:
University of Nebraska-Lincoln Agricultural Research and Development Center (ARDC) near Mead, Nebraska at the August N. Christenson Research and Education Building

Physical Address:
1071 County Road G * Ithaca, NE 68033

Directions:
http://ardc.unl.edu/direct.shtml * (402)624-8000

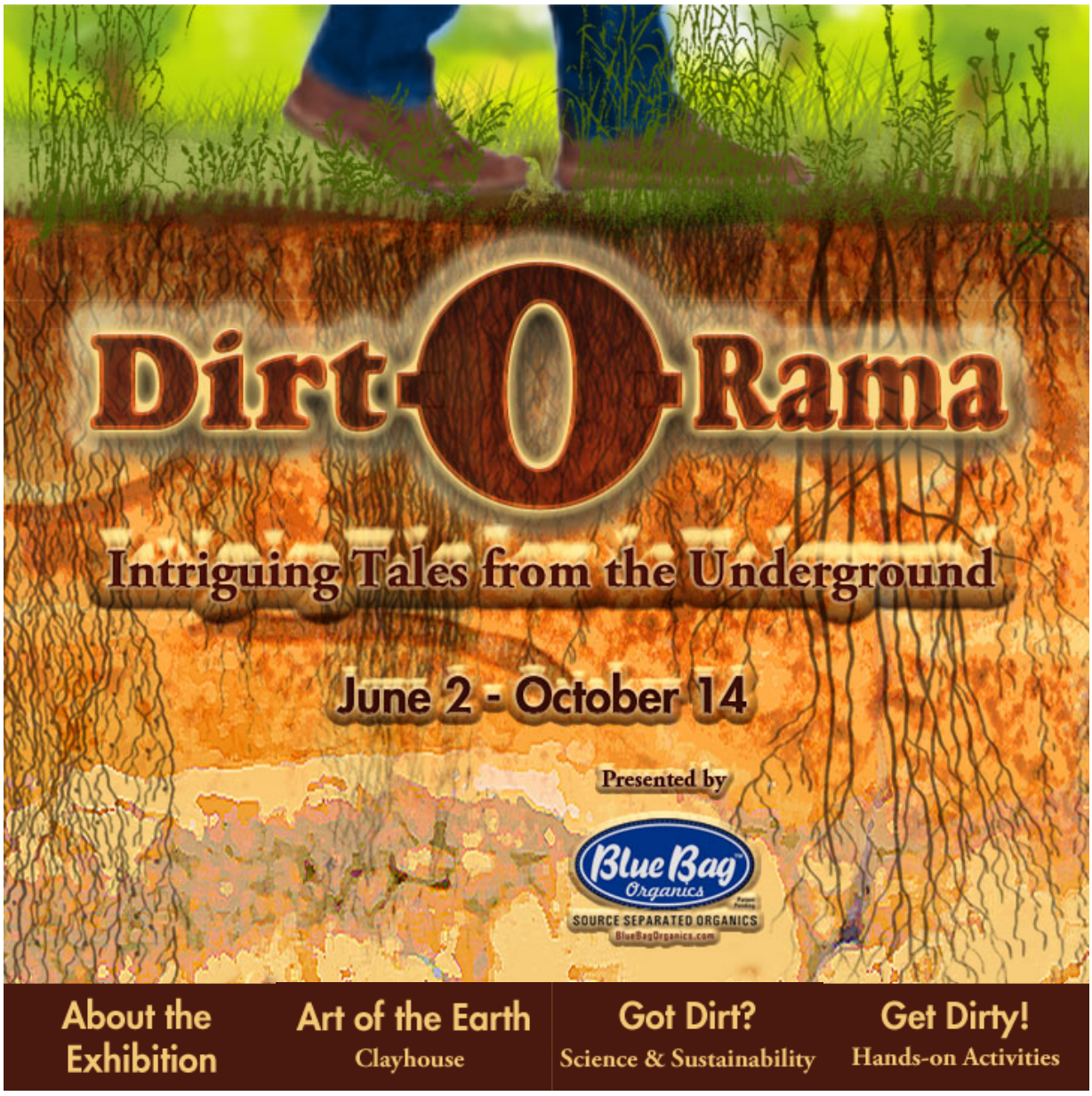
Agenda:

10:00 a.m.	Registration and Welcome
10:05 a.m.	Biomass Biofuel policy, Switchgrass Genetics and Next Generation Bioenergy Varieties *Ken Vogel, Supervisory Research Geneticist, USDA ARS: Forage Breeding*
11:30 a.m.	Switchgrass and Bioenergy Crop Logistics - *Stuart Birrell, Associate Professor Department of Ag and Biological Engineering, Iowa State University*
12:15 p.m.	Lunch
1:00 p.m.	Switchgrass Establishment, Weed Control, Herbicides, Seed Quality - *Robert Mitchell, Research Agronomist, USDA ARS, AssociateProfessor UNL Department of Agronomy*
1:45 p.m.	Today's Markets for High Yield Switchgrass Varieties
2:30 p.m.	Drill Calibration Exercise - *Robert Mitchell*
3:00 p.m.	Planting Demo (weather permitting)
3:30 p.m.	Safe Travels Home

Registration and Questions:
Register by March 16 to reserve your seat. Contact John Hay , Extension Educator, University of Nebraska–Lincoln, (402) 472-0408 or jhay2@unl.edu.

IANR

University of Nebraska–Lincoln Institute of Agriculture and Natural Resources



10 Is Biochar a Good Amendment for Your Soil?

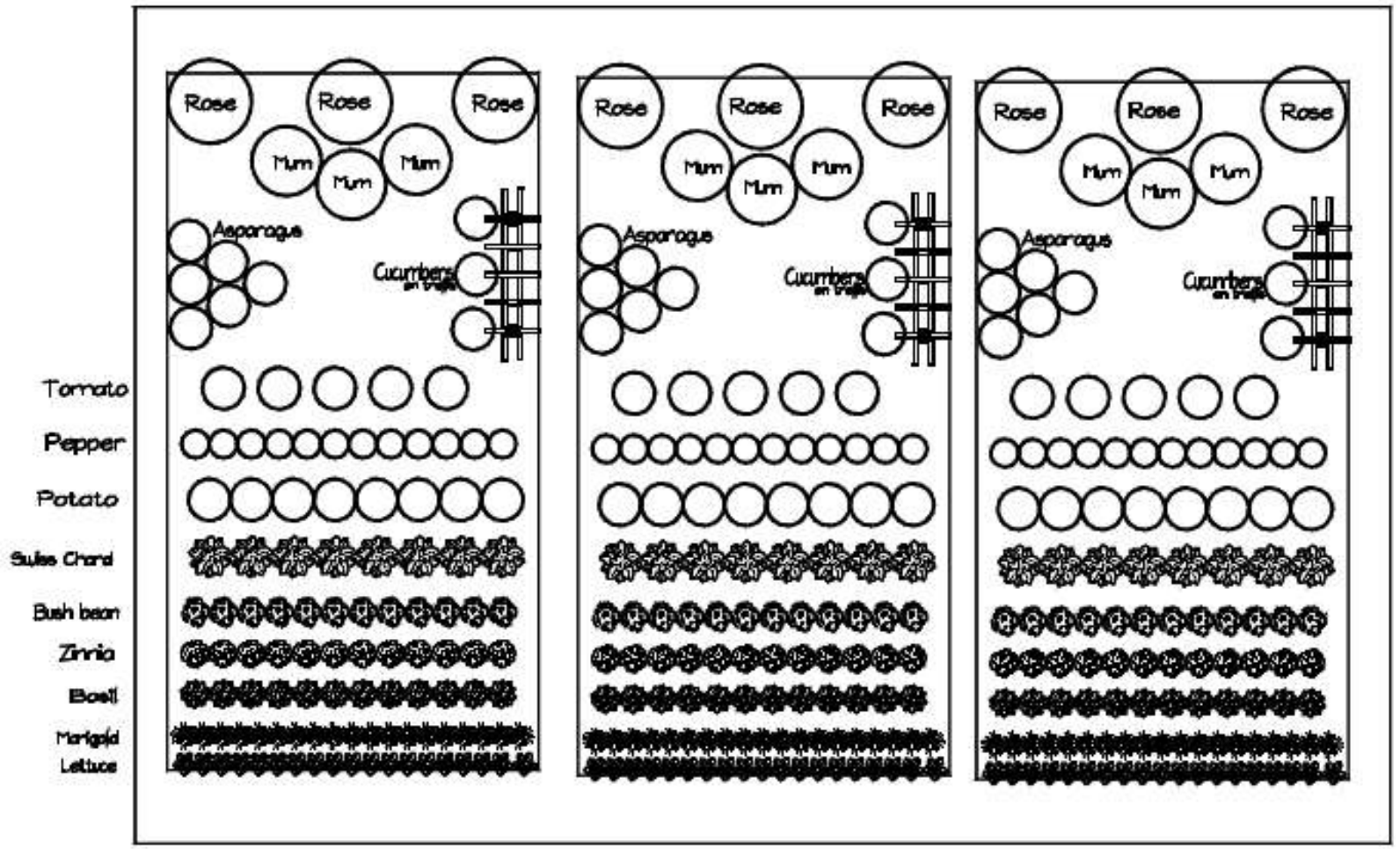
Designers: U of M Extension Master Gardeners

Collaborators: USDA/CenUSA Bioenergy Project; MN Landscape Arboretum, U of M Department of Horticultural Science, Anoka County Parks District

Biochar is a carbon-rich, solid byproduct of pyrolysis, a process used to convert biomass into biofuel. But could biochar be a good soil amendment for home gardens? To answer this question, University of Minnesota Extension Master Gardeners will test the productivity of vegetable and flower gardens amended with biochar at three Minnesota sites. This is a 4-year, national research project funded by the USDA National Institute for Food and Agriculture. For more information: http://www.cenusa.iastate.edu/

Materials: Biochar, annual and perennial flowers, vegetables, shrub roses, switchgrass

CenUSA Bioenergy - Biochar garden plot design



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SCALE IN FEET

Designer: J. Weisenhorn, U of MN
April 26, 2012

N

CENUSA BIOCHAR GARDEN DESIGN

J.Weisenhorn
5/8/2012

	ANNUALS				
ID	**Plant name**	**Approximate Number of plants per treatment per site**	**Width (in.)**	**Height (in.)**	**Comments**
1	Lettuce 'Red Sails'	19	8	10	
2	Marigold, 'Little Gem"	19	8	12	Yellow, orange, small blossoms
3	Basil 'Italian Large Leaf'	12	10	15	
4	Zinnia 'Uproar Rose'	12	10	15	
5	Bean 'Blue Lake 284 bush'	12	12	18	
7	Swiss Chard 'Bright Lights'	8	12	18	
8	Potato 'Kennebec'	8	18	20	Mounded
9	Pepper 'Mariachi hybrid'	12	12	24	
11	Tomato 'Celebrity'	5	18	48	In cages
13	Cucumber 'Tasty Green Hybrid'	3 per trellis	36	72	On tripod
	PERENNIALS		144		
ID	**Plant name**	**Number of plants per treatment per site**	**Width**	**Height**	**Comments**
14	Mum, 'Gold Country'	1	30	20	Yellow; early September
15	Mum, 'Maroon Pride'	1	30	20	Maroon; late August
16	Mum, 'Betty Lou'	1	20	30	Pink; early July bloom
17	Rose, Northern Accents 'Sven'	1	36	48	Pink shrub rose
18	Rose, Northern Accents 'Lena'	1	36	48	Pink shrub rose
19	Rose, Northern Accents 'Ole'	1	36	48	Pink shrub rose
20	Asparagus 'Jersey Night'	1	12	48	Perennial
21	Switchgrass - variety TBD	1	48	60	From Mary's grass collection

Program Evaluation - Biomass Crop Production Workshop

March 8, 2012 - Creston, Iowa

Complete this page before the workshop begins

1. Please indicate your level of understanding for the following items.

circle your choice below

	none	low	moderate	hight
developing biomass energy markets around Iowa	5	9	8	2
perennial grass biomass crops	4	8	12	1
industries developing biomass in Iowa	5	10	8	1
government programs supporting biomass production	5	13	5	6
biomass energy in general	3	10	9	2

2. How did you hear about this meeting?	newspaper/ magazine	e-mail / web page-8	employer-7	other-9
3. Which age range are you in?	under 25 8	26-45 6	46-65 8	over 65 2
4. What best describes your occupation?	farmer 3	energy industry 3	ag retail/ agronomist 3	educator 4
	agency-federal 8	agency-state	student 6	other 1

5. For farmers and/or land owners, how many acres do you manage?

Acres	Responses	Total Acres
360	1	360
1200	1	1200
3000	1	3000
Total		4560

Please turn in this page before the program begins. Thank you!

IOWA STATE UNIVERSITY
Extension and Outreach

Program Evaluation - Biomass Crop Production Workshop

March 8, 2012 - Creston, Iowa

Complete this page at the end of the workshop

6. Now that the workshop is over, please indicate your level of understanding for the following items.

circle your choice below

	none	low	moderate	high
developing biomass energy markets around Iowa		5	12	1
perennial grass biomass crops		3	13	2
industries developing biomass in Iowa		8	8	1
government programs supporting biomass production		7	8	3
biomass energy in general		2	14	2

7. What is your overall rating for this program?	Poor	Fair 1	Good 13	Excellent 4
8. How would you rate the facilities based on ease of access, parking, comfort and food?	Poor	Fair 1	Good 8	Excellent 8

9. What additional topics do you think should have been included in today's program?

- What projects/other industry types are doing outside of Southern Iowa/Northern Missouri. There are a lot of projects in the works that might be able to jump start this part of the U.S.
- More production oriented.
- I think all topics were discussed adequately
- Potential profitability for farmers/producers when growing miscanthus or other biomass crops.
- None – I think it was lots of information for one meeting.
- Cost and value in $.
- More on switchgrass & other perennials. Ways to market the crop.
- Logistic challenges facing biomass industry. Financial model to show justification to change cropping practices

10. Please list one or two things that you learned today and how those will benefit your operation or influence your decision to produce biomass for energy production.

- Poultry industry-target for miscanthus. Types of land in this area-places contain enough marginal land.
- I learned that a lot of things will need to be put into place to win the support of the traditional farmers in the area; also there are many opportunities to open custom businesses in the industry.
- Bcap. Marketing. Production.
- Basic knowledge
- Bcap information. Networking
- What types of biomass is out there besides corn, showed that we are capable of doing a biomass project.
- Need several marketing options. Flexibility in harvesting miscanthus. Will share with SWCD commissioners what I learned today.
- Gained knowledge to take out to interested people
- Another possible alternative crop that doesn't conflict with row crop production

- What type of plant materials to use for energy production
- How to make biomass crops profitable for farmers
- Steve Flick is great. John Caveny was good.
- Features of biomass. Understanding of Bcap.
- The general knowledge about miscanthus and the different planting, management, harvesting techniques.
- Cost of establishing miscanthus. Presence of industries using biomass for energy.
- How resilient miscanthus is & it would be good for the university.

11. Any additional comments or suggestions to improve future programs?

- Work ISU is performing on miscanthus/energy crops.
- Program was good. Have more of them.
- Would be great if you could get more farmers to attend. Don't know how you achieve that
- Keep the open format
- How beneficial miscanthus can be.
- I would have liked to have some handouts from Steve & John.
- Really enjoyed the small groups!
- How do we get a group started? LLC? Coop? use RC&D?
- I had a previous commitment, so I arrived late, 10:45. Missed some speakers.

cenusa bioenergy

"Our vision is to create a regional system for producing advanced transportation fuels derived from perennial grasses grown on land that is either unsuitable or marginal for row crop production. In addition to producing advanced biofuels, the proposed system will improve the sustainability of existing cropping systems by reducing agricultural runoff of nutrients and soil and increasing carbon sequestration."

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