cenusa bioenergy

Quarterly Progress Report

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

March 2012

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

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IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

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March 15, 2012

Mark Goldner
National Program Leader, Division of Bioenergy
Institute of Bioenergy, Climate and Environment
United States Department of Agriculture
National Institute of Food And Agriculture
1400 Independence Ave.
Washington DC 20250-2201

Dear Mr. Goldner:

On behalf of Dr. Ken Moore and the entire Cenusa Bioenergy research team, we are submitting our first Cen**usa** Bio**energy** quarterly report covering the period August 2011 through February 2012. This submission is in response to your recent request to begin submitting quarterly reports detailing our progress towards the goals outlined in Grant No. 2011-68005-30411.

Cen**usa** Bio**energy** will be submitting reports every quarter from now until the end of the funding period, as well as the annual reports required by the terms of the award.

Very truly yours.

Anne Kinzel
COO, Cen**usa** Bio**energy**

Cenusa Bioenergy is supported by USDA.NIFA Grant No. 2011-68005-30411

NOTICE

This quarterly report was prepared by Iowa State University and Cen**usa** Bio**energy** 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: August 1, 2011 – January 31, 2012

PROJECT ADMINISTRATION

1. Project Organization and Governance Accomplishments

Cen**usa** Bio**energy** ("Cen**usa**") has hired a Chief Operating Officer (Anne Kinzel) and a Business Manager (Val Evans) to handle project administration and business affairs. Kinzel assists Project Director Ken Moore in all aspects of Cen**usa** 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. Revised Timelines

Each of the nine Cen**usa** objectives has been revised to reflect the reduced funding level available to the project once the award was issued in August 2011. The revised timelines were submitted to the NIFA-CAP project leadership in January 2012. (See Appendix A)

b. Advisory Board

Advisory Board recruitment was completed in December 2012, with the addition of two farmer/producers to the Board, Ben Steffen from Nebraska and John Weis from Minnesota. All links in the in the supply chain including biomass cultivar development and seed production and marketing, crop production, transportation, storage, conversion, marketing, safety, and education are now represented on the Advisory Board. (See Appendix B)

c. Coordination, Collaboration, and Communication

- **Project Kickoff Meeting.** The entire Cen**usa** team and the Advisory Board met in Ames, Iowa on August 30-31, 2011. Each of the nine objectives presented an overview of their Objective timelines for project years 1-5. The Advisory Board and project leaders and collaborators provided extensive feedback to each Objective. At the conclusion of the meeting, Advisory Board members provided observations and suggestions to each Objective team.

- **Executive Team Meetings.** The eighteen objective leaders have been meeting with Moore and Kinzel via a regularly scheduled monthly net meeting held in Cen**usa**'s dedicated Adobe Connect meeting room. This 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 Cen**usa** Objectives participate in scheduled meetings using the Cen**usa** Adobe Connect meeting room.

- **External Meetings.**

  ✓ Members of the Cen**usa** Executive Team attended the Sustainable Bioenergy Project Directors Meeting October 24-26, 2011 in Washington, DC. This allowed the Executive Team to meet face to face with Coordinated Agricultural Project grantee colleagues from Louisiana State University, University of Tennessee, University of Washington, Washington State University, as well as other NIFA (AFRI-CAP) sponsored researchers and USDA project leaders

  ✓ Project Director Ken Moore participated in the annual meeting of CAP project administered by Vadim Kochergin at Louisiana State University (January 23-25, 2012). During the meeting, objective area leaders presented updates on their activities allowing Moore to identify potential areas of collaboration with the Cen**usa** project. Moore was also able to participate in their Advisory Board meeting and learn how members are interacting with the SUBI project. Moore believes that it is important to develop working collaborations with all the other CAP projects to better leverage resources.

- **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 C). Ken Vogel, Supervisory Research Geneticist at the USDA Agricultural Research Service-Northern Plains and leader of the Cen**usa** Germplasm to Harvest research group**,** will host the 2012 Summit.

- **Communication Platforms.** Cen**usa** has extensive internal and external communication needs. Internally, we have focused on creating a platform to quickly disseminate and exchange materials among the 91 collaborators disbursed across the project's nine objectives.

  Our external obligations revolve around our need to communicate with numerous stakeholders, including industry professionals, agricultural and horticultural producers, educators, agency personnel, community leaders, extension educators, and the general public. We have to be able to broadly disseminate reports, learning modules, articles, and webinars to these groups. We also have to inform these

groups of Cen**usa** events and activities available for their participation, such as educational meetings, webinars, media events, eXtension bioenergy learning modules, field days, and networking opportunities.

To meet our communication needs, Cen**usa** has established the following communication tools:

- ✓ **Project Website** – http://www.cenusa.iastate.edu. The website provides for both external (public) pages and internal pages with secure access for project collaborators and the Advisory Board.
- ✓ **Twitter Account** – @Cenusabioenergy This Twitter account allows us to rapidly dispense information about Cen**usa** to interested parties across the globe. We also use this tool to promote our outreach activities.

We have worked with Objective 9 (Extension and Outreach) to create three short promotional videos telling the Cen**usa** story. These pieces are in final production and will be available to use in our outreach activities as well as on the Cen**usa** website.

2. Plans for Next Quarter

- **Financial Matters.** The Administrative Team will complete the process of reducing the year 2 budget to meet the funding provided by the USDA-NIFA.
- **Program Matters.** We will focus on project coordination, communication, meetings and data sharing across Objectives, and on reaching the revised timelines milestones.
- **Annual Summit.** We will finalize the preparations for the 2012 Annual Summit.

3. Publications, Presentation, Proposals Submitted

Ken Moore is preparing a white paper for the 2012 Farm Bill.

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

- Initiate plans for regional yield tests of cultivars and experimental stains, develop research protocols, and confirm all nursery cooperators.

- Develop research approaches with laboratories conducting composition and small-scale pyrolysis research.
- Develop initial research plans with participating entomologists and plant pathologists.
- Initiate all staffing actions.

2. Actual Accomplishments

- Two switchgrass genetic nurseries were established in the spring of 2011 in Nebraska and Wisconsin for this project.
- Seed was harvested from experimental strain seed increases at both Nebraska and Wisconsin in September and October 2011. This seed will be used in regional trial evaluation and breeding nurseries.
- All harvested seed has been cleaned for use in project trials.
- Plans were developed for the regional trials and all nursery cooperators were confirmed.
- Developed plans for breeding and genetics nurseries to be established in 2012.
- Staffing actions proceeded on schedule.

3. Explanation of Variance

No variance has been experienced and accomplishments are on schedule.

4. Plans for Next Quarter

- 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 2012-field season.
- Establish seedlings for genetics studies in greenhouse for field transplanting in June 2012.

5. Publications, Presentations, and Proposals Submitted

- Kenneth P. Vogel, “Biofuels and the Environment: Environmental Assessment Endpoints for Feedstock Production” (Invited presentation to an Environmental Protection Agency Workshop, Alexandria, Virginia, November 29, 2011). The presentation focused on perennial grasses. Vogel provided information on Cen**usa** Bio**energy** and other perennial grass biofuels research.

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

- Initiate plans for establishing plots for the 2012-growing season.
- Set up communication systems within Objective 2 and across Cen**usa** objectives for project coordination.

2. Actual Accomplishments

- A monthly conference call for Objective 2 participants was established using the Adobe Connect communication platform. Protocols and methods for sampling soils, plants and the atmosphere were the primary discussion points of these calls.
- The team drafted, discussed and ultimately adopted for use protocols for soil sampling and analysis and greenhouse gas sampling and analysis.
- The team also developed protocols for establishing 1-acre plots on marginally productive land in order to demonstrate rapid and economically feasible establishment, best management practices, and feedstock yield potential. The protocols were approved for implementation in the 2012-growing season.

3. Explanation of Variance

No variance has been experienced and accomplishments are on schedule.

4. Plans for Next Quarter

- Finalize plans and protocols for new plots that need to be established under Task 2.
- Purchase inputs for plot establishment in the 2012-growing season.
- If the weather permits, acquire baseline soil cores from plots.

5. Publications, Presentations, and Proposals Submitted

None to report this period.

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

Two activities were planned during the fall harvest period:

- Drying studies of perennial grasses; and
- Quantification of energy requirements for harvest and size-reduction using forage harvesters and balers.

2. Actual Accomplishments

- A drying study quantified the effect of three treatments on the field-drying rate of switchgrass. Treatments included conventional conditioning (CC), intensive conditioning (IC) and intensive conditioning plus tedding (ICT). The ICT material was ready to bale on the second day after cutting and the IC material on the third day. The CC material required an additional day of drying before baling.
- A study quantified 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 between 40 and 55% (w.b.). Average post-harvest particle-size (as quantified by ASABE Standard S424.1) was close to the TLC except for the 5 mm TLC, where average particle-size was roughly twice that of the TLC. Specific fuel use ranged from 2 to 4 L/Mg DM and fuel use, as a function of TLC was best fit as a power function. Mass-flow-rate ranged from 15 to 30 Mg DM/h.
- Another study quantified 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 20% (w.b.) moisture. The harvesting rate ranged between 20 and 27 Mg DM/h. Fuel use ranged between 0.8 and 1.1 L/Mg DM. Reed canarygrass required significantly less fuel per unit mass than switchgrass. Pre-cutting did not affect final bale density.

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3. Explanation of Variance

The team had planned for additional drying studies, but the standing crop moisture dropped below 30% (w.b.) so quickly in the fall of 2011 that there was no value in additional drying work. Additional drying studies will take place in fall 2012.

4. Plans for Next Quarter

The forage harvester and baler studies outlined above will be repeated using crop that has over wintered to quantify the energy requirement differences due to crop physical properties. The team will conduct an additional study that quantifies the energy required to size-reduce the reed canarygrass and switchgrass bales made in fall 2011 and also in spring 2012. 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 the next quarter. Finally, if sufficient land area can be identified, additional perennial grass fields will be established to support harvest activities.

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

- The team has acquired and is testing the most recent version of the Environmental Policy Impact Climate (EPIC) model, which 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).

- The team has 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.

3. Explanation of Variance

No variance has been experienced and accomplishments are on schedule.

4. Plans for Next Quarter

The team 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, "The Potential for Agricultural Land Use Changes in the Raccoon River Basin to Reduce Flood Risk: A Policy Brief for the Iowa Flood Center" (Presentation to the University of Iowa Flood Center, Iowa City, Iowa, December 15, 2011).

- The article "An Overview of Carbon Offsets from Agriculture" is under consideration for publication in the *Annual Review of Resource Economics* 4, October 2012 www.annualreviews.org.proxy.lib.iastate.edu:2048/doi/abs/10.1146/annurev-resource-083110-120016. The expected final online publication date for the *Annual Review of Resource Economics* (Volume 4) is September 5, 2012.

POST-HARVEST

Objective 5. Feedstock Conversion and Refining

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 Cen**usa** 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

Determine pyrolysis testing protocols and experimental plan and initiate acquisition and characterization of biochars.

2. Actual Accomplishments

Laboratory research has been initiated to determine the chemistry of a diverse group of biochars, and biochar field plot studies have been initiated to assess the impact of biochar on soil quality and carbon sequestration. The Brown and Boateng teams have conferred on protocols to be employed in performing micropyrolysis trials. In particular, the methodology for calibrating for levoglucosan, the major anhydrosugar product of cellulosic biomass pyrolysis, was determined to employ dissolved samples of levoglucosan rather than dry samples to assure complete devolatilization.

Major accomplishments during the reporting period include the acquisition of a diverse group of biochars including: red oak biochar produced by fast pyrolysis at 500°C, corn stover biochar produced by fast pyrolysis at 500 and 700°C, mixed hardwood by gasification biochar produced at 500°C, a thermal series of cellulose biochars produced by slow pyrolysis at 300 to 600°C, and a thermal series of corn stover biochars produced by slow pyrolysis at 300 to 600°C. On-going laboratory analyses to determine the bulk and surface chemistry of the biochars include: proximate analysis, ultimate analysis, potentiometric titrations, Bohem titrations, thermogravimetric analysis, and FTIR spectroscopic analysis.

The suitability of biochar for use as a soil amendment and the capacity of biochar to function as a carbon sequestration agent are being addressed in three sets of long-term biochar field trials, in coordination with Objective 2. Major accomplishments during the reporting period include establishment of 16 new large scale (0.354 ha) biochar research plots in October of 2011 with controls (0 Mg/ha) and biochar (24 Mg/ha) treatments on the Iowa State University Armstrong Research and Demonstration Farm in Pottawattamie County, Iowa. Time zero soil samples were collected for these plots and are currently being analyzed to quantify initial soil organic carbon stocks and other soil quality parameters.

3. Explanation of Variance

We have decided to use long-term biochar field plot trials to quantify the stability of biochar C and C sequestration potential of biochar. The field plot studies have the advantage of providing realistic field environment, but are limited in the number of biochars that can be studied. Laboratory incubations are being used to compare the relative stability of different biochars.

4. Plans for Next Quarter

Laboratory work will focus on refining the Bohem titration method for characterizing the acid-base chemistry of biochar surfaces. This method was developed for characterization of activated carbons and needs to be revised for use with biochars, which contain higher ash levels.

Pyrolysis trials at Boateng's laboratory will commence once Objective 1 (Nebraska ARS team) supplies germplasm samples.

5. Publications, Presentations, and Proposals Submitted

- David Laird, Douglas Karlen, Pierce Fleming, and Natalia Rogovska “Impact of Biochar Applications, Residue Harvesting and Traffic Intensity On Soil Quality After Three Years” (Presentation at the annual international meeting for the American Society of Agronomy-Soil Science Society of America, San Antonio, Texas, October 18, 2011).
- Rivka Fidel, David Laird and Michael Thompson “Analysis of Biochar’s Acid-Base Properties” (Presentation at the annual international meeting for the ASA-SSSA, San Antonio, Texas, October 19, 2011).
- David Laird, “Biochar Field Studies” (Workshop - Coupled climate-crop model development to improve regional climate simulation, Iowa State University, November 7, 2011).

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
- The evaluation of impacts of the expanded advanced biofuel system on regional and global food, feed, energy, and fiber markets.

1. Planned Activities

The Objective 6 team planned activities for the first two project quarters are:

- Study and quantify the production and location-specific barriers and drivers of implementation of the entire system from producers of feedstock, producer groups and their stakeholders, and the biofuel producers; and

- Estimate threshold returns that make feasible biomass production for biofuels.

2. Actual Accomplishments

Hayes submitted research that shows Midwest farmers will grow corn and corn stover instead of switchgrass unless there is a market or subsidy value for carbon. They show how to calculate the size of the carbon subsidy that is needed to induce farmers to grow switchgrass. (See Publications, Presentations, and Proposals Submitted, below)

Perrin submitted recent research that will inform and guide our analysis on biomass production costs and supply. His research finds that three delivery points in Nebraska can be supplied annually with a million Mg of corn stover biomass at \$69 - \$76 Mg^{-1} dry matter but that these quantities are achievable for switchgrass biomass at higher prices, an estimated \$80 Mg^{-1}. (See Publications, Presentations, Proposals Submitted, below)

3. Explanation of Variance

No variance has been experienced and accomplishments are on schedule.

4. Plans for Next Quarter

With a definition for marginal land still forthcoming, Objective 6 activities will begin with a baseline assumption that certain lands in CRP are candidates for switch grass biomass production. The team will use CRP data (rents, acres, parcel characteristics) to begin to develop cost estimates of switchgrass production on CRP lands and develop the comparisons to corn production. Objective CoPd. Hayes' research on the necessary carbon subsidy needed to induce switchgrass production on those lands over corn production will be utilized. Assumptions on expected yields and production costs will be determined in collaboration with other objective areas.

5. Publications, Presentations, and Proposals Submitted

- Kauffman, Nathan and Dermot Hayes. Farmer and societal decision on whether to grow corn or switchgrass for use as energy crops. Manuscript.

- Perrin R., Sesmero J, Wamisho K, Bacha D. Biomass supply schedules for Great Plains delivery points. Biomass and Bioenergy 2012; 37:213-220.

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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.
- The risks of air/dust exposure

1. Task 1 – Managing Risks in Producing Feedstocks

a. Planned Activities

The team initiated the collection and definition process for identifying the various duties and responsibilities associated with producing feedstocks for use in risk assessments for hazards.

b. Actual Accomplishments

The major duties and responsibilities associated with producing feedstocks have been preliminarily identified.

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 as the year progresses.

e. Publications, Presentations, and Proposals Submitted

None to report this period.

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. **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:

- 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 undergraduates 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 previously led in 2009.

Subtask 1: Curriculum Development

1. Planned Activities

- Identify topics for the 10 modules to be developed in years 1 and 2.
- Hire graduate students and staff member to assist with module development program.
- Complete outline of the first module *Perennial Grass Physiology, Growth and Development.*

2. Actual Accomplishments

- Topics for modules to be developed in Project Years 1 and 2 identified.

- Graduate students identified to assist with modules related to harvesting, storage, logistics and marketing.
- Position announcement for module development coordinator completed.
- Outline of first module completed.

3. Explanation of Variance

Receipt of funds for hiring staff member was delayed so a formal position announcement was not made public. This issue was been addressed and will not adversely affect the program.

4. Plans for Next Quarter

- Hire staff member to coordinate the module development program.
- Complete 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*

5. Publications, Presentations, and Proposals Submitted

None to report this period.

Subtask 2A: Training Undergraduates via Internship Program

1. Planned Activities

- Prepare a detailed schedule for inaugural summer program (2012).
- Contact Cenusa faculty members and solicit projects.
- Develop website to advertise program and accept applications.
- Website goes live.

2. Actual Accomplishments

- Detailed schedule for inaugural summer program (2012) completed.
- Projects solicited from Cen**usa** faculty members.

3. **Explanation of Variance**

   We have had challenges getting the website live due to personnel issues in the servicing department. It is our understanding that these have been solved and that we will be going live shortly. The delay in the website means we will be pushing our application deadlines back by approximately one month, but we believe that this will not adversely affect the program.

4. **Plans for Next Quarter**

   - Website goes live by Feb 13, 2012.
   - Application deadline of March 30, 2012.
   - Applications vetted centrally and likely candidates sent to faculty by April 6, 2012.
   - Offers to students by April 13, 2102, selections finalized by April 20, 2012.
   - Final program prep during late April and early May (student travel, lodging, stipend payment methods to partners).

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 Cen**usa**'s link to the larger community of agricultural and horticultural producers and the public-at-large. The team delivers science-based knowledge and informal education programs linked to Cen**usa** Objectives 1-7.

To carry out the extensive tasks necessary to produce Objective 9 deliverables we have created the following teams:

- **Extension Staff Training/eXtension Team**

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

- **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. No activity is scheduled in in Project Years 1 and 2.

- **Health and Safety Team**

  The Health and Safety team integrates its work with the Producer Research Plots/Perennial Grass team and does not have any separate activities to report for the first two quarters of the project.

- **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**

  This team helps to coordinate the extensive extension and outreach activities. The team is also charged with developing the evaluation mechanisms for assessing the project's Extension and Outreach Activities. This team does not have any separate activities to report for the first two quarters of the project.

1. Extension Staff Training/eXtension Team

a. Planned Activities

- Two learning modules
- Four webinars
- Four eXtension articles

b. Actual Accomplishments

- Establish bi-monthly meetings with Objective 9 Extension and Outreach Team.
- Review of existing Bioenergy Training extension offerings:
  - ✓ Available at the University of Wisconsin Bioenergy Training Center Modular Course Series (http://fyi.uwex.edu/biotrainingcenter/online-modules/)
  - ✓ Exploring the feasibility of incorporating new Cen**usa** learning modules into the existing Bioenergy Training Center Modular Course Series framework.
  - ✓ Exploring an alternative approach to present new Cen**usa** learning modules through a stand-alone web presence. A example of this approach can be viewed at: http://blogs.extension.org/cenusa-mod1/.
- Started drafting Education Module #1. John Guretzky has produced a rough draft covering:
  - ✓ Seed structure/seedling emergence activity
  - ✓ Plant structure text based lesson
  - ✓ Leaf and Tiller Growth presentation
  - ✓ Study questions

- Started exploration of various custom outreach applications for use in constructing learning modules.
  - ✓ Tools under consideration available at: http://
  - ✓ engage.wisc.edu/software/index.html

c. Explanation of Variance

The Extension and Outreach team is working closely with the Education team (Objective 8) to develop learning modules, webinars and articles that target our specific audiences with minimal overlap or duplication of effort. Content development has been occurring within the education and research teams, while exploration of online delivery is happening within the Extension team. Once content has been developed, the Extension team will translate the content for its specific audience, filling in gaps where necessary, and making information available in a variety of accessible formats. The accomplishment of this team is therefore dependent upon the content development from other teams.

d. Plans for Next Quarter

- Transition Education Module #1 content into Extension and Outreach materials.
- Develop webinars and articles based on available content and identified needs.
- Continue bi-monthly team meetings.

e. Publications, Presentations, and Proposals Submitted

None to report this period.

2. Producer Research Plots/Perennial Grass Team

a. Planned Activities

- Identify four cooperating producers and field sites to establish on-farm demonstration plots in year 1 (Iowa, Nebraska, Indiana, Minnesota).
- Develop a list of best management practices (BMPs) to demonstrate in on-farm demonstrations
- Develop learning modules/webinars/eXtension articles

b. Actual Accomplishments

- One producer and field site has been recruited in each state:
  - ✓ Brad David, Blakesburg, Iowa

- ✓ Jeremy Sweeten, Roann, Indiana
- ✓ Ben Steffen, Humboldt, Nebraska[1]
- ✓ John Weis, Elko, Minnesota[1]

- Selection of BMPs to be demonstrated (on-farm demonstrations) has been completed.
- Reviewed existing publically available online switchgrass education materials to avoid duplicating existing pieces.
- Coordinated effort between the University of Nebraska-Lincoln's New Media Center and the ISU Bioeconomy Institute to develop Cen**usa** promotional videos.
- Collected raw footage film for switchgrass harvest and bailing video. The script has been written and edited.
- Completed the rough draft of Education Module #1 (Author John Guretzky) which includes:
  - ✓ Seed structure/seedling emergence (activity)
  - ✓ Plant structure (text based lesson)
  - ✓ Leaf and Till Growth presentation
  - ✓ Study Questions
- A shared online space (SmartSheet.com) has been developed to coordinate education and extension material development efforts.
- Field Day planned for March 20, 2012 (Mead, Nebraska). Target audiences are extension educators, NRCS personnel, and cooperating producers. Content will also be shared through webinars. Topics are seedbed preparation and establishment. A video production crew has been secured for capturing video at the field day for use in Cen**usa** learning modules.

c. Explanation of Variance

No variance has been experienced and accomplishments are on schedule.

d. Plans for Next Quarter

- Finalize protocols for establishing on-farm field plots.

[1] Ben Steffen and John Weis have also agreed to serve on the Cen**usa** Advisory Board.

- Host training session for cooperating producers and Extension educators on BMPs for 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.
- Host field day at Mead, Nebraska (March 20, 2012). Film activities.
- Finish switchgrass harvest video.
- Conduct webinars using materials developed at the March 20, 2012 field day.
- Film field day for planting learning module.
- Create planter calibration demonstration video, using Mead field day footage.
- Finish module 1 for John Guretzky and begin Module 2.
- Assemble Module #1.

e. Publications, Presentations, and Proposals Submitted

None to report this period.

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

3.A – Youth Development

a. Youth Development – Planned Activities

- Hire PhD student to assist.
- Review available bioenergy curriculum for youth audiences.
- Begin planning 4-H bio-renewables curriculum.
- Collaborate with Purdue Cen**usa** team members to utilize research and extension plots for education and outreach.

b. Youth Development – Actual Accomplishments

- Hired a PhD student to assist with project coordination and progress towards completion of Objective 9 tasks and deliverables.
- Purdue Cen**usa** Youth team has met four times in face-to-face meetings to discuss project objectives and tasks for years 1 and 2.

- Iowa State and Purdue Cen**usa** youth team meeting by conference call.
- Developed timeline for completion of year 1-2 tasks.
- Completed review of available bioenergy curriculum targeted at youth audiences. Very little age appropriate content that is experientially based is currently available.
- Discussed implementation of school-based biochar project, including involvement of master gardeners.
- Formulated a plan for building a comprehensive *4-H BioRenewables* (working, not final, title) curriculum. Created a list of topics for initial fact sheets and activity development.
- Began development of 4-H BioRenewables fact sheets.
- Met with Purdue Agriculture Exhibit Design Center to discuss production of a display for an Indiana State Fair Exhibit.

c. Youth Development – Explanation of Variance

- Purdue Cen**usa** Youth team will share research and extension demonstration plots in year one, until establishment of school and youth programs provides suitable education demonstration locations.
- School based biochar project will first be implemented fall 2012, allowing time for adequate development of a project plan, classroom materials, recruitment and training of master gardener volunteers, and piloting of potential models.

d. Youth Development – Plans for Next Quarter

- Demonstrate learning activities at Indiana youth events in June 2012.
- Continue development of fact sheets (8 planned); topics include pyrolysis, biomass production, biochar utilization, biofuels, and carbon and nutrient cycling.
- Begin to coalesce fact sheets and activities into a 4-H curriculum.

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

- Develop supporting educational materials for educating Master Gardener (MG) volunteers, teaching materials for the volunteers to use, and social media for engaging MG volunteers.
- Establish web presence and social media.
- Develop MG volunteer job description for biochar demonstration and community gardens.
- Recruit and educate Master Gardener Core Volunteers (Core Volunteers) and identify demonstration sites.
- Develop learning package of teaching materials for Core Volunteers and local MG county agents and volunteers.
- Recruit additional MGs.

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

- Weisenhorn and Jeannette have developed social media to connect Consumer Horticulture (CoP for Master Gardener program) and Sustainable BioEnergy eXtension Communities of Participations.
- Google map developed as online tool for the public locating and learning about demonstration sites.
- Jeannette will focus on linkages between the Consumer Horticulture and Bioenergy eXtension Communities of Participations.
- MG volunteer job descriptions are complete.
- Volunteer recruitment for the Minnesota and Iowa projects is in process:
  - ✓ Minnesota MG Project Manager Hagen has scheduled eight in-person recruitment events and two online reaching approximately 800 volunteers. After the initial inquiry, Master Gardener volunteers will be asked to complete a more detailed application regarding their time availability and commitment to the project. From that pool approximately 75-80 volunteers will be selected to maintain three separate garden sites and to assist at public outreach events.
  - ✓ Master Gardener volunteers will be recruited through Minnesota and Iowa State program offices.
  - ✓ MG Volunteer selection process will conclude by the end of February.
- Hagen and Weisenhorn will be speaking at Master Gardener monthly update meetings in the Twin City metro area to promote volunteerism for this project.

- Cen**usa** MG project was promoted at a local Anoka (Minnesota) County Extension Committee meeting that included two county commissioners in attendance.
- MG demonstration sites have been selected in three locations in Minnesota:
  - ✓ The University of Minnesota - St. Paul Campus (Display and Trial Garden), Rosemount Research and Outreach Center (http://rroc.cfans.umn.edu), and the Minnesota Landscape Arboretum (http://www.arboretum.umn.edu).
  - ✓ MG demonstration sites have been selected in Iowa.
- MG horticulture bed design and plant materials have been selected based on David Laird's research, input from faculty, and common plants a home gardener might select for their landscape.
- Research conducted on potential biochar sources. To-date, Royal Oak Industries product looks most accessible.
- The Team has organized the following activities that will feature Cen**usa** Bio**energy** in 2012:
  - ✓ The 2012 Upper Midwest Master Gardener Conference at the MN Landscape Arboretum will feature a presentation on the project by Hagen (Cen**usa**) and possible Cen**usa** faculty.
  - ✓ The featured exhibition at the Minnesota Landscape Arboretum for 2012, "Dirt-O-Rama" will feature special exhibits and hands-on displays about the importance of soil. The Cen**usa** Biochar demo site will be a featured educational display on all visitor promotional materials.
- The Team will meet April 19-20, 2012, in Dubuque, Iowa.

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

a. The learning packet for MG volunteers has not been finalized, as we would like to incorporate from educational tools from others on the project.

b. **Minnesota Volunteer Recruitment.** Minnesota does not have county agents/program coordinators in each county, so Minnesota recruitment is done through the state Master Gardener office.

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

- Establish initial MG biochar demonstration gardens. All sites are on schedule for planting.

- Build connections to the National Junior Master Gardener program and Extension Master Gardeners.
- MG Core Volunteers coordinate planting demonstration sites.
- Coordinate demonstration sites.
- Expand social media presence.
- Develop learning package for MGs and teachers to use in educational programs.
- Develop supporting educational materials for educating volunteers, teaching materials for the volunteers to use, and social media for engaging Master Gardeners (MG) volunteers; post materials on-line.
- Develop online and electronic assessment tools to measure youth and adult outputs and outcomes.

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

- University of Minnesota Extension Communications published the following article, "U of M scientists, Master Gardeners part of team to analyze biofuel production, land use" (http://blog.lib.umn.edu/umnext/news/2011/11/u-of-m-scientists-master-gardeners-part-of-team-to-analyze-biofuel-production-land-use.php) (November 2011) in the media / social media listed below:
  - ✓ News section of the UMN Extension Master Gardener Site
  - ✓ Canadian Business
  - ✓ Columbus IN Republic
  - ✓ CBS Minnesota
  - ✓ Bemidji Pioneer
  - ✓ WQOW Eau Claire, WI
  - ✓ Rochester Post Bulletin
  - ✓ Hutchinson Leader
  - ✓ Pioneer Press
  - ✓ Crookston Daily Times
  - ✓ KEYC Mankato

- ✓ Bioenergy Industry News
- ✓ KSTP (University of Minnesota version)
- ✓ Hampton News
- ✓ Wahpeton Daily News

Exhibit A

CENUSA BIOENERGY REVISED TIMELINES & DELIVERABLES

Jan. 25, 2012

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.

Cenusa Bioenergy is supported by USDA.NIFA Grant No. 2011-68005-30411

Iowa State University - AFRI-CAP (Revised)

Objective 1 - Feedstock Development	Year 1 (2011-2012)				Year 2 (2012-2013)				Year 3 (2013-2014)				Year 4 (2014-2015)				Year 5 (2015-2016)			
	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4
Task 1 - breeding and evaluation trials establishment.																				
Task 2 - stands, harvesting, sampling																				
Task 3 - Selections made for crossing																				
Crossing and seed production																				
Cultivar and germplasm releases																				
	The project started on August 1, 2011. The first quarter of Year 1 is August thru Dec., 2011. Quarter 2 for the period 2011-2012 is Jan thru March , 2012.																			
	Green bars are the first set of selection nurseries and yield trials. Yellow bars are the 2nd set of yield trials and selection nurseries.																			
	See Tables 1 and 2 of Feedstock Section for specific details																			

Feedstock development: Specific milestones and objectives are given in the appendix time line and is the response to Specific Technical Question 2. In brief, two cultivars each of switchgrass, big bluestem, and indiangrass will be released in five years and six to 12 experimental strains will be developed for a second cycle of regional field trials. A detailed summary is listed below.

Risks and mitigation: The two primary factors that could affect the completion of milestones and objectives during the five year period are the stability and continuity of USDA funds and weather. Funding issues will simply have to be jointly addressed by NIFA and project managers as they occur. It may be necessary to delay or repeat some work, such as establishment of breeding nurseries or field trials, if weather conditions result in stand failures. This would delay reaching milestones but milestones and objectives could still be met.

Metrics: Major Products & Deliverables

Year 3

1. Adaption & production data on all available strains
2. Composition and pyrolsis data on feedstocks
3. Initial NIRS calibrations for pyrolysis products.
4. Plant disease and insect resistance data on tested lines.

Year 4

1. Best experimental strains identified for release.
2. Completion of first selection cycle. Data on genetic variation on composition & pyrolysis products.

Year 5

1. Switchgrass, big bluestem indiangrass cultivar releases
2. Experimental strains developed for 2nd testing cycle.
3. Fully validated NIRS calibrations for pyrolyis.
4. Advanced selection criteria developed utilizing molecular marker and pyrolsis related traits.

Research phases and timetable for a perennial forage breeding program. Obj. 1

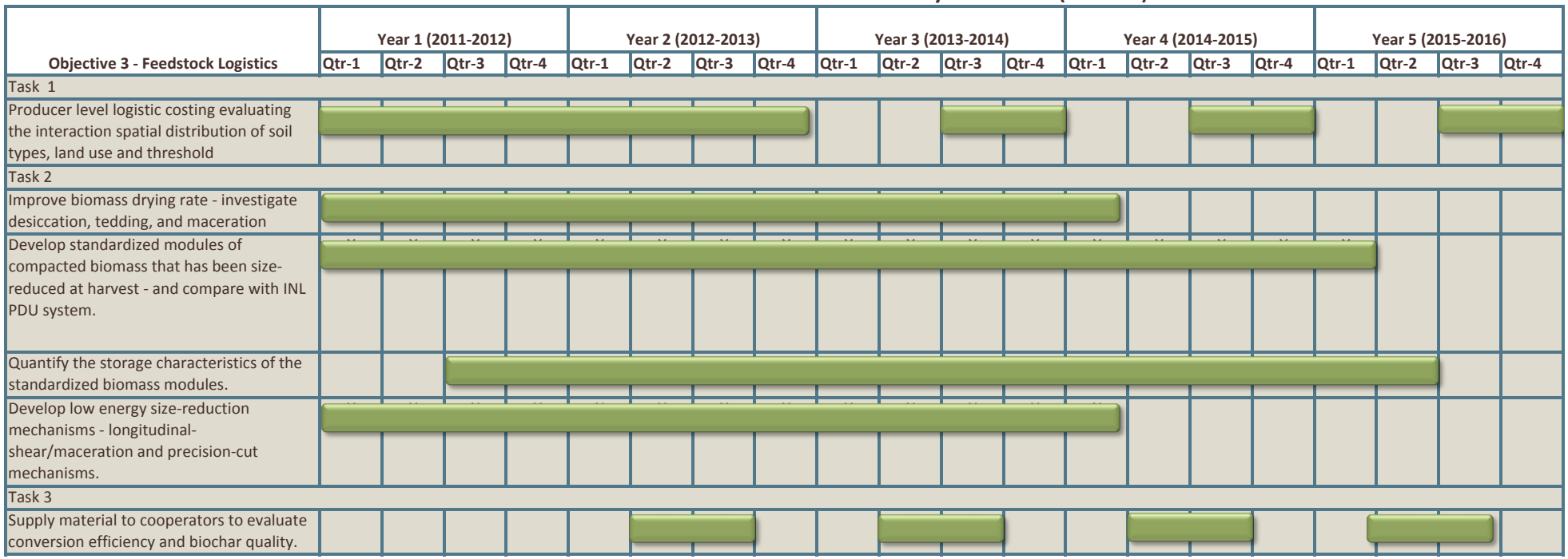
Phase	Year 1	Year 2	Year 3	Year 4	Year 5
Phase 1: Germplasm acquisition & evaluation	Establish germplasm evaluation nurseries.	Evaluate forage yields, quality, and other traits	2nd year of evaluation	Identify superior plants and move to crossing blocks, initial seed harvest	Harvest seed. Use seed in Phase 2. Synthetic populations may need to be random mated several generations.
Phase 2: Recurrent selection breeding program.	Establish selection nurseries using seed from selected germplasm sources.	Evaluate forage yields, quality, and other traits	2nd year of evaluation	Identify superior plants and move to crossing blocks, initial seed harvest	Harvest seed, repeat cycle in breeding program. Use seed to plant regional trials.
Phase 3: Regional small plot trials	Plant trials	Harvest trials	Harvest trials	Summarize data, begin seed increase of best strains for pasture trials or field scale trials.	Seed harvested from increase nurseries
Phase 4: Field scale or grazing trials of advanced lines	Plant field or pastures trials.	Field or grazing trial production harvests.	Field or grazing trial production scale harvests.	Increase best strain for release. Continue to monitor trials.	Release seed to seed growers

Iowa State University - AFRI-CAP

(Revised 11.11.11)

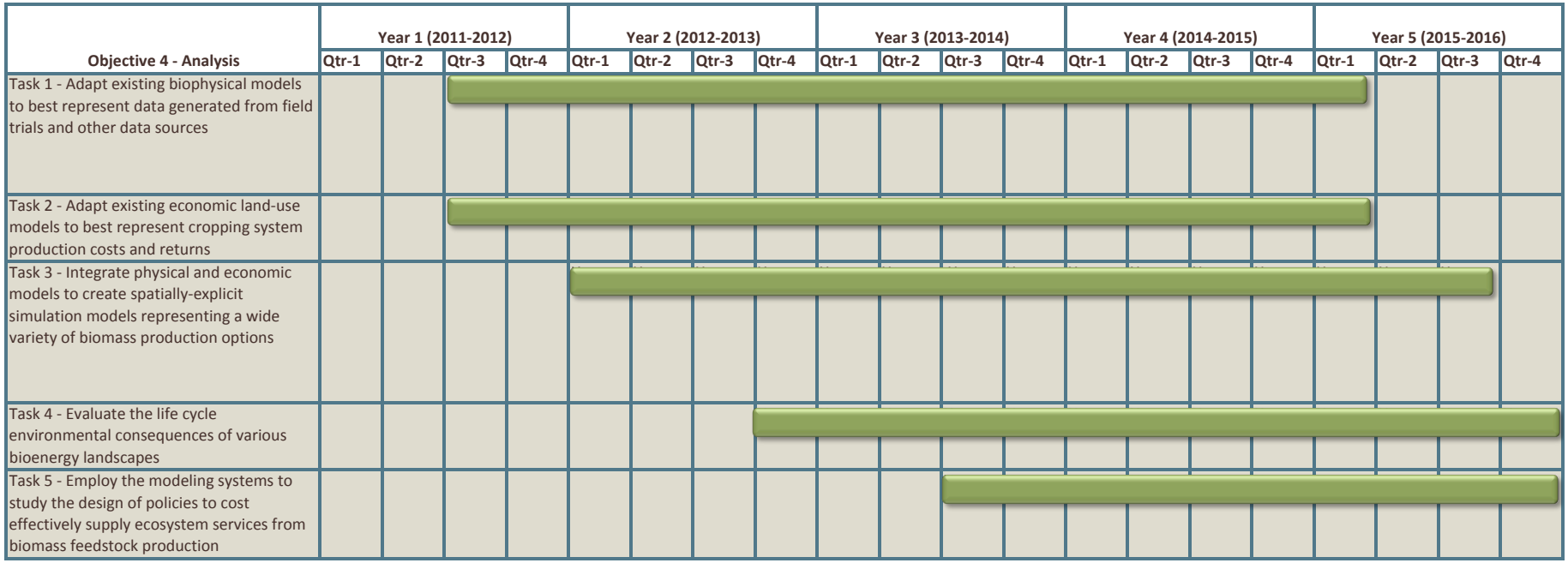
Objective 2 - Sustainable Production	Year 1 (2011-2012)				Year 2 (2012-2013)				Year 3 (2013-2014)				Year 4 (2014-2015)				Year 5 (2015-2016)			
	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4
Task 1 - Identify sites, complete initial soil profile sampling (1.2 m depth) and establish experimental plots for both biomass production and biochar plot studies																				
Task 2 - Annual plot management, GHG flux monitoring, surface soil (0-15 cm depth) sampling, harvest and biomass sampling																				
Task 3 - Plot management, GHG flux monitoring, surface soil profile (1.2 m depth) sampling, harvest and biomass sampling																				
Task 4 - Data compilation, statistical analysis, report writing, and data archiving																				

Iowa State University - AFRI-CAP (Revised)



Objective 3 - Feedstock Logistics	Year 1 (2011-2012)				Year 2 (2012-2013)				Year 3 (2013-2014)				Year 4 (2014-2015)				Year 5 (2015-2016)			
	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4
Task 1																				
Producer level logistic costing evaluating the interaction spatial distribution of soil types, land use and threshold																				
Task 2																				
Improve biomass drying rate - investigate desiccation, tedding, and maceration																				
Develop standardized modules of compacted biomass that has been size-reduced at harvest - and compare with INL PDU system.																				
Quantify the storage characteristics of the standardized biomass modules.																				
Develop low energy size-reduction mechanisms - longitudinal-shear/maceration and precision-cut mechanisms.																				
Task 3																				
Supply material to cooperators to evaluate conversion efficiency and biochar quality.																				

Iowa State University - AFRI-CAP (Revised)



Iowa State University - AFRI-CAP (Revised)

Objective 5 - Conversion/Refining	Year 1 (2011-2012)				Year 2 (2012-2013)				Year 3 (2013-2014)				Year 4 (2014-2015)				Year 5 (2015-2016)			
	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4
Task 1 - Identify germplasm																				
Task 2 - Perform technoeconomic analysis (TEA)																				
Task 3 - Prepare and characterize biochar																				

Timeline Note: Quarter 1 of Year 1 will cover the start of the project (August 1, 2011) through December 31, 2011. Year 1 will end Sept. 30, 2012. Years 2-5 will begin October 1 and end September 30.

Deliverables and Metrics

Year 2

1. Understanding of how lignin can be used along with carbohydrate for fuel production.

Year 3

1. Understanding of the form and fate of inorganic compounds (alkali and nitrogen) in plant materials.
2. Public and market acceptance of biochar as a soil amendment and carbon sequestration agent

Year 4

1. Analytical methods to support selection of suitable feedstocks.
2. Estimates of environmental impacts of biofuels production; and cost of biofuels for different feedstock production scenarios.

Year 5

1. Biomass feedstocks designed specifically for thermochemical processing.
2. Improved understanding of the interrelationship of feedstock supply and biofuels manufacturing systems.

Iowa State University - AFRI-CAP

(Revised 11.11.11)

Objective 6 - Markets and Distribution	Year 1 (2011-2012)				Year 2 (2012-2013)				Year 3 (2013-2014)				Year 4 (2014-2015)				Year 5 (2015-2016)			
	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4
Task 1 - Study and quantify the production- and location-specific barriers and drivers of implementation of the entire system from producers of feedstock, producer groups and their stakeholders, and the biofuel producers																				
Task 2 - Perrin (UNL) will estimate threshold returns that make feasible biomass production for biofuels																				
Task 3 - Jacobs (ISU) with input and expertise from Hayes (ISU) and Perrin (UNL) will develop the set of market, contract and policy mechanisms necessary to make optimal and sustainable the production of biomass feedstock on the identified lands																				
4. Jacobs (ISU) will develop a decision model to predict the likelihood that the targeted land identified within Objective 4 will be used for perennial biomass crop production, accounting for returns to biomass and row crop production, market conditions and policy and contract incentives and mechanisms.																				

5. Hayes (ISU) will use existing national and global agricultural policy simulation models that endogenize prices to estimate scale effects of bio-energy production on national and international commodity markets and greenhouse gas (GHG) emissions on regional and global food, feed, fiber and energy systems both with and without indirect land use impacts using the Food and Agricultural Policy Research Institute (FAPRI) model																				

Iowa State University - AFRI-CAP (POST BUDGET CUT)

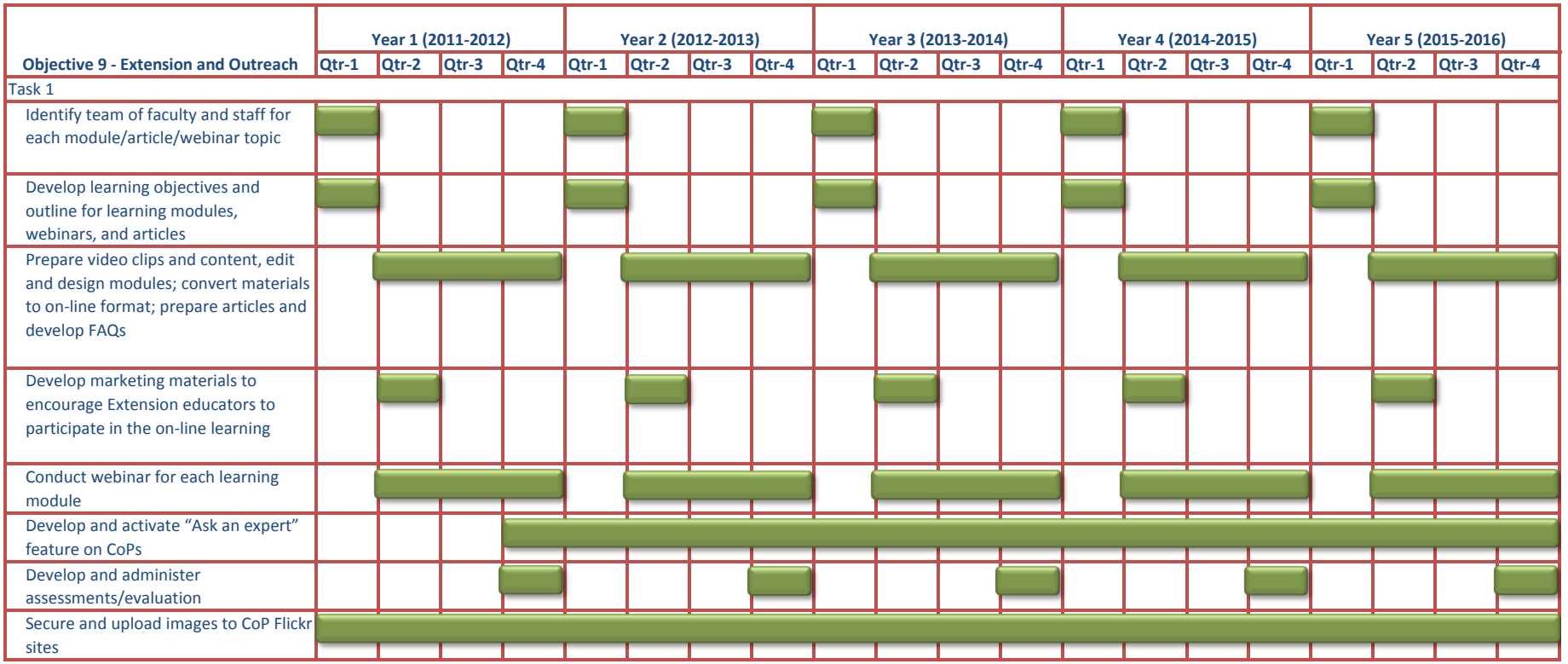
Objective 7 - Health and Safety	Year 1 (2011-2012)				Year 2 (2012-2013)				Year 3 (2013-2014)				Year 4 (2014-2015)				Year 5 (2015-2016)			
	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4
Task 1 - Managing risks in producing feedstocks																				
Task 2 - Assessing the primary dust exposure																				

Iowa State University - AFRI-CAP

(Revised 11.11.11)

Objective 8 - Education	Year 1 (2011-2012)				Year 2 (2012-2013)				Year 3 (2013-2014)				Year 4 (2014-2015)				Year 5 (2015-2016)			
	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4
Task 1 - Course module development																				
Task 2 - 8-week research internship experiences																				
Task 3 - Native Perennial Grass Bioenergy 2-week Intensive Program (NAPERG-IP)																				

Iowa State University - AFRI-CAP



Year 1 Deliverables

Deliverables: 2 learning modules, 2 webinars, and 4 eXtension articles re: a) Perennial grass establishment: variety selection, seed quality, seedbed prep, seeding depth; b) Post-establishment fertilizer: amount, kind, timing; c) Post-establishment weed control; images uploaded to eXtension Flickr sites

Deliverable: Online peer network for Extension Educators launched

Year 2 Deliverables and Metrics

Deliverables: 2 learning modules, 2 webinars, and 4 eXtension articles re: a) Biomass harvest systems; b) Biomass storage systems, costs, and consequences;
c) Economics of biomass feedstock production systems

Deliverables: Online curriculum for Extension Educators (eXtension Sustainable Agriculture Energy Community of Practice)

Deliverables: Identify topics for "Ask an Expert"; identify and activate "experts" for each topic

Metric: 100 Extension Educators and industry professionals will gain awareness and knowledge in bioenergy topics (indicator measured by online surveys six months following participation in learning activities)

Years 3-5 Deliverables and Metrics

Deliverables: 6 learning modules, 6 webinars, and 12 eXtension articles re: a) Pyrolysis conversion systems; b) Biochar utilization; c) Environmental impacts of perennials in the landscape; - d) Insect control; e) Plant diseases; f) Harvesting: timing, cutting height, environmental conditions including drought; g) producer decision support tools

Objective 9 - Extension and Outreach	Year 1 (2011-2012)				Year 2 (2012-2013)				Year 3 (2013-2014)				Year 4 (2014-2015)				Year 5 (2015-2016)			
	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4

Metric: 400 Extension Educators and industry professionals will gain awareness and knowledge in bioenergy topics (indicator measured by online surveys six months following participation in learning activities)

Metric: 250 Extension Educators will incorporate bioenergy learning activities into their educational outreach programs (indicator measured by online surveys six months following learning activities)

Extension and Outreach Task 2	
Plan and conduct educational meetings, conferences, workshops, field days, media events, eXtension bioenergy learning modules, webinars, and networking activities about perennial biomass feedstocks, logistics, safety, processing, and economics; and utilization of pyrolysis biochar as a soil amendment for producers, agricultural industry, horticulturalists, educators, and agency personnel	
Develop and utilize assessments of awareness and knowledge gained	

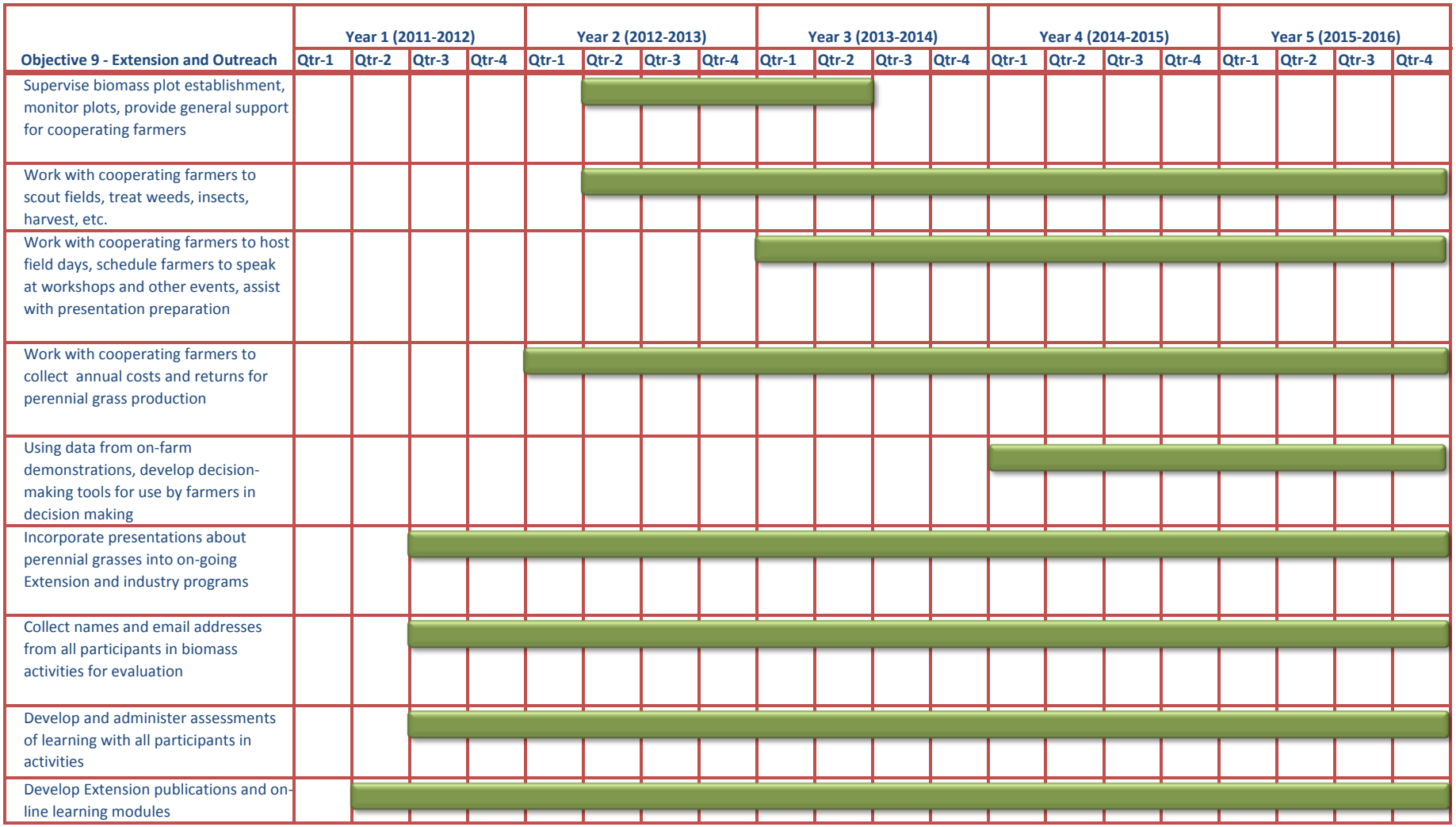
Years 2-5 Deliverables

Deliverables: 100 educational meetings, conferences, workshops, field days, media events, eXtension bioenergy learning modules, webinars, and networking activities re: perennial biomass production BMPs; biomass logistics, safety, processing, economics; BMP for biochar as a soil amendment

Metric: 8,000 agricultural producers, agricultural industry leaders, educators, and agency personnel and 500 horticultural producers and industry leaders will: a) gain awareness and knowledge regarding environmental, economic, and public relations impacts of transitioning marginal crop land to perennial grass, b) understand the impacts of biochar as a soil amendment (indicator measured by post-event surveys)

Extension and Outreach Task 3	
Recruit 2 producer cooperators/state to establish biomass demonstration plots; negotiate contracts	
In cooperation with Objective 1 faculty, design biomass demonstration plot protocols	

Iowa State University - AFRI-CAP



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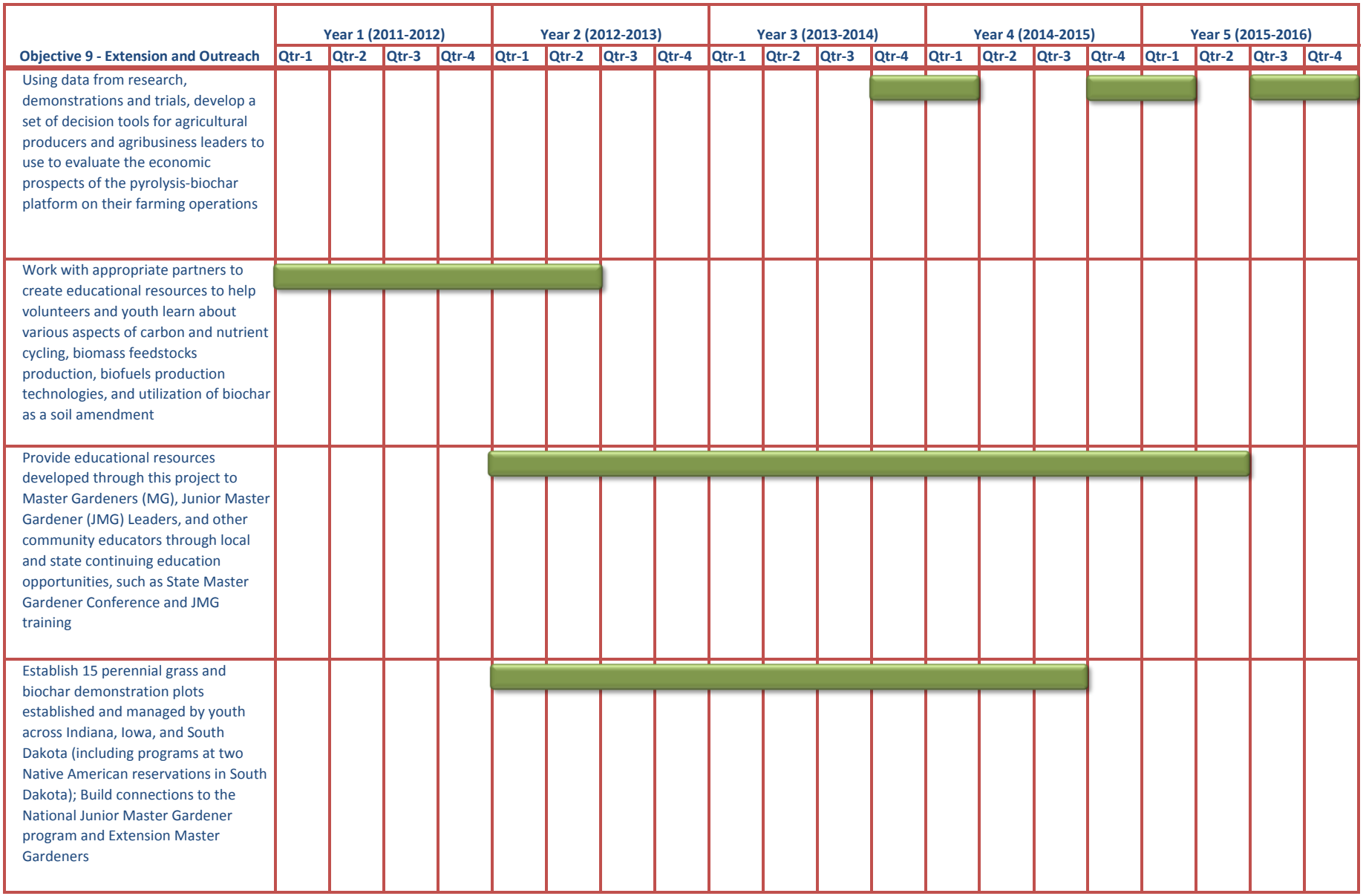
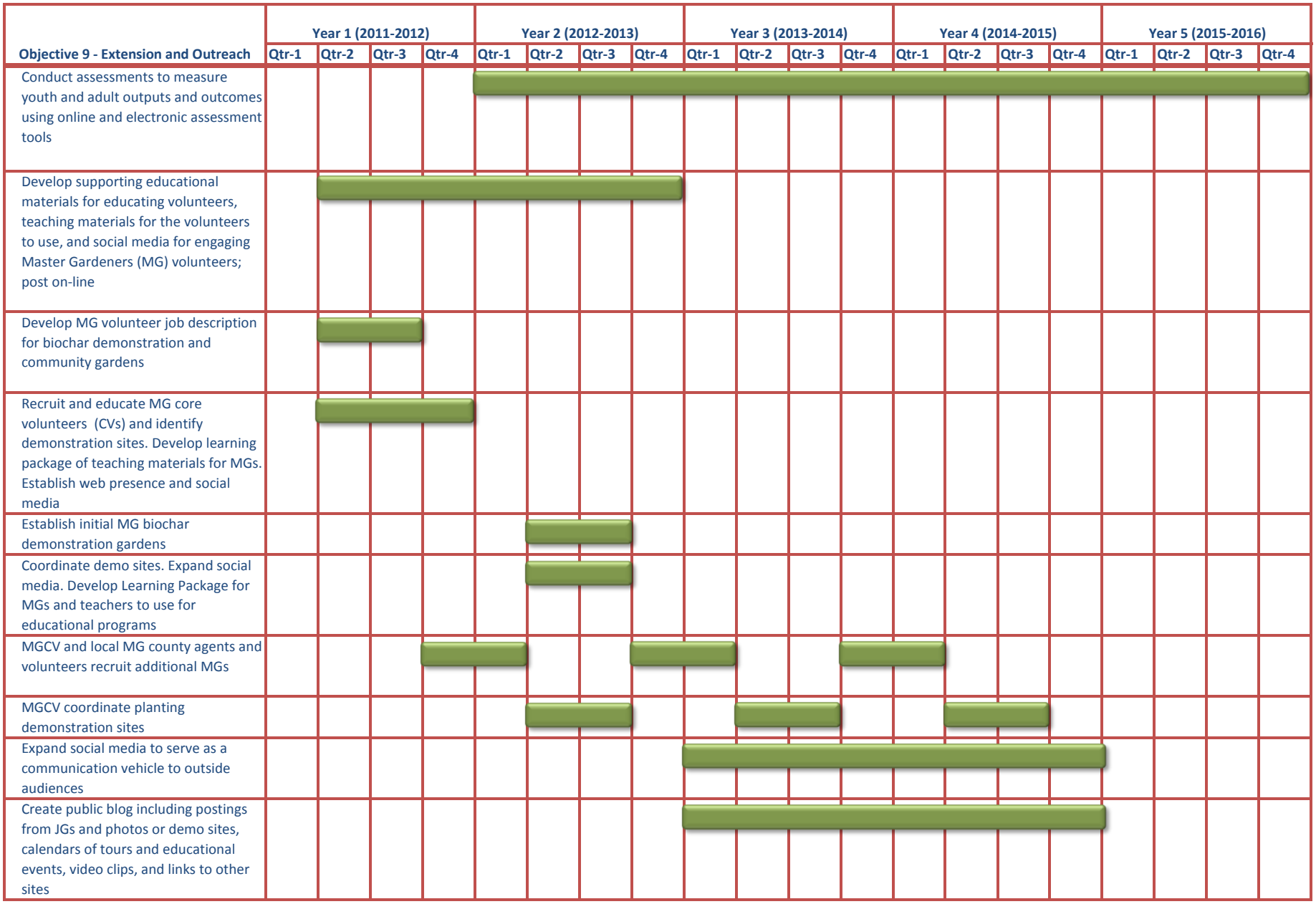


Iowa State University - AFRI-CAP



Objective 9 - Extension and Outreach	Year 1 (2011-2012)				Year 2 (2012-2013)				Year 3 (2013-2014)				Year 4 (2014-2015)				Year 5 (2015-2016)			
	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4
Collect names and email addresses of participants in events and on-line activities																				
Conduct assessments of knowledge gained and behavior changes																				

Years 1-5 Deliverables and Metrics

Deliverables: 8 on-going perennial biomass feedstock production demonstrations and 10 biochar field trials
Deliverables: 18 on-farm perennial crop field days and 18 on-farm biochar field days hosted by collaborating producers
Deliverables: Publicly avalable and accessible data, webinars, and online learning modules from the perennial grass demonstrations and biochar tirals
Deliverables: 10 community garden biochar demonstration plots established
Deliverables: Tests and documentation for federal and state approvals for use of biochar as a soil amendment
Deliverables: Decision tools for ag producers and leaders to evaluate economic prospects of the perennial crops and biochar
Deliverables: Learning modules for youth re: perennial grasses, carbon cycling, and biochar utilization
Deliverables: Evaluation and research data
Metric: 3,000 agricultural producers will gain knowledge of BMPs for establishing perennial grasses and/or utilizing biochar (indicators measured by pre/post activity surveys and open-ended questionnaires)

Metric: 750 horticulturalists and gardeners will gain knowledge regarding impacts of utilizing biochar in horticultural applications (indicators measured by pre/post activity surveys and open-ended questionnaires)
Metric: 5,000 4-H, FFA, and K-12 science students will gain awareness and knowledge of biomass production, biofuels production, and carbon and nutrient cycling topics after participating in youth activities (indicators measured by pre/post activity surveys and open-ended questionnaires)
Metric: 5,000 youth will gain awareness and knowledge related to careers in Science, Engineering, and Technology (SET) as a result of participating in 4-H, K-12 classroom and FFA learning experiences (indicators measured by pre/post activity surveys and open-ended questionnaires)

Extension and Outreach Task 4																				
Work with cooperating farmers to collect annual costs and returns for perennial grass production																				
Create whole-farm decision support tools for perennial grass production and biochar utilization and post online																				
Develop tutorial for using decision support tools; post online																				

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Objective 9 - Extension and Outreach	Year 1 (2011-2012)				Year 2 (2012-2013)				Year 3 (2013-2014)				Year 4 (2014-2015)				Year 5 (2015-2016)			
	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4	Qtr-1	Qtr-2	Qtr-3	Qtr-4
Develop workshop curriculum for use by Extension personnel to teach producers and ag industry leaders to use the tools																				
Collect names and email address for workshop participants and online users for evaluation purposes																				
Develop and administer assessment of learning																				

Exhibit B

Cen**usa** Bio**energy** Advisory Board

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Working Schedule for the CenUSA Annual meeting at 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 (Coffee & soda available)
	1830-2030	Group dinner (At local restaurant)	
August 8			
	0730-0800	USDA- NIFA comments (Continental Breakfast @ 7:30)	Lincoln Downtown Holiday Inn (Coffee available for whole morning)
	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 (Coffee available for whole morning)
	1000-1015	Break	
	1015-1200	Continue planning including Administrative planning	
	1200	**Adjourn**.	
	1300-xxxx	Individual team meetings as arranged.	

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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