V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Sustainable Energy - Biofuels and Biobased Products

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
101	Appraisal of Soil Resources	0%		3%	
102	Soil, Plant, Water, Nutrient Relationships	8%		7%	
111	Conservation and Efficient Use of Water	8%		0%	
125	Agroforestry	8%		0%	
131	Alternative Uses of Land	8%		0%	
136	Conservation of Biological Diversity	8%		0%	
202	Plant Genetic Resources	0%		3%	
205	Plant Management Systems	5%		8%	
302	Nutrient Utilization in Animals	8%		0%	
402	Engineering Systems and Equipment	8%		26%	
403	Waste Disposal, Recycling, and Reuse	8%		0%	
404	Instrumentation and Control Systems	0%		45%	
511	New and Improved Non-Food Products and Processes	8%		8%	
601	Economics of Agricultural Production and Farm Management	8%		0%	
602	Business Management, Finance, and Taxation	8%		0%	
605	Natural Resource and Environmental Economics	7%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	1.9	0.0	5.5	0.0

Actual Paid	1.1	0.0	3.3	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
149936	0	460916	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
149936	0	460916	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
127095	0	7456703	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Extension programming will focus on advising farmers interested in biomass production on the risks and benefits of crops as biofuels. Extension will form a 'Stover team' to explore possibilities. The team will be made up of multiple partners with interests in biomass. Iowa State University will focus resources and efforts on developing improved crops and plant materials for use as feedstocks to produce biofuels and biobased products while still producing adequate food and feed supplies; developing agronomic practices to produce these feedstocks in sustainable ways to mitigate environmental risks; developing new harvesting, storing and transporting systems for these new feedstocks; and adopting new conversion processes that are more efficient, use less energy and water, and produce value-added co-products. These technologies will be integrated so that they work as a complete system and the ISU BioCentury Research Farm will play a key role.

Faculty participate in relevant multistate research committees: NC213, NC1178, NC1183, NC1194, NE1042, S1041, W2128.

2. Brief description of the target audience

Efforts in this program focus on basic human needs for environmentally sustainable energy and consumer goods (e.g. building construction materials, plastics and adhesives), producers with more efficient crops and production systems, rural communities with new employment opportunities and economic development, processing companies with advanced conversion technologies, and all Iowans because of the need for inexpensive and environmentally acceptable forms of energy. Producers and landowners need to know the opportunities and risks associated with biomass production and harvest.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	2397	374	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2014

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	0	11	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of people who attend an educational activity to learn about producing biomass.

Year	Actual
2014	2397

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of producers who increase their awareness of crop production strategies appropriate for bioenergy production.
2	Number of individuals who increase their knowledge in production/harvesting systems related to biomass crops.
3	Corn Stover Processing Research Creates New Enterprises

Outcome #1

1. Outcome Measures

Number of producers who increase their awareness of crop production strategies appropriate for bioenergy production.

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Number of individuals who increase their knowledge in production/harvesting systems related to biomass crops.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	119

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

A.

For the U.S. to be less dependent on fossil fuels, on-farm research is needed to demonstrate the feasibility of growing perennial grasses for biomass that can be converted to biofuel. This effort requires creating awareness among and educating extension educators, industry professionals, and Community Leaders in bioenergy production and marketing issues, especially regarding environmental and society benefits. The goal is to stimulate the adoption of perennial grass production among crop producers, help them make informed economic decisions regarding grass production, and show the value of biochar, a by-product of the pyrolytic conversion of biomass, as a soil amendment.

B.

The volatility of crop production inputs such as fuel and energy presents risks to producers in terms of profitability and environmental impacts. To address these risk factors, Extension programming will focus on production, harvesting, and storage practices to enhance on-farm

energy efficiency and energy conservation.

What has been done

A.

Multiple field demonstrations plots have been implemented to show producers the best way to establish and manage perennial grasses for biomass on crop land. In addition, 2 sessions at the 2014 Integrated Crop Management Conference were presented on perennial grasses for bioenergy production and nutrient management, attended by 221 people. Two additional sessions were presented on cost of production of perennial biomass crops (51 people attended). A bioenergy exhibit was developed for the Vermeer Dealer Days conference, where several perennial grass plots have been established to show visitors production practices. Data will be collected from these plots. Two perennial grass plots have been established in SE Iowa where field days in 2015 will be conducted.

B.

An educational workshop was developed and delivered by Extension staff to youth age 18-23 to illustrate production and harvesting practices to improve overall energy efficiency and energy conservation in crop production. Examples of crop production practices from the workshop include, but are not limited to, selecting early-maturing crop hybrids to maximize in-field drying of plant biomass and/or grain prior to harvest or increasing the energy efficiency of existing grain drying equipment by adjusting the drying temperature to consume less total fuel.

Results

A.

As a result of attending a biofuels field day, participants' knowledge on 7 topics related to biofuel crop harvest have been significantly improved. Out of 16 people who attended this field day, 12% significantly increased their knowledge regarding the Renewable Fuels Standard and the latest EPA rulings and 14% learned significantly more about precision ag methods for biomass harvest.

Another field day resulted in 58% (n=24) will consider planting a bioenergy crop, such as a perennial grass, if a market developed in their area; 50% will consider using perennial grasses for nutrient management, erosion control, or livestock production; 15.3% provided their email addresses to receive additional information about perennial grasses for bioenergy.

Responses from participants at a field day on perennial grass management resulted in 36% of respondents who said they will consider planting a perennial grass if a market develops in their area (n=36); 70% of respondents who indicated they are producers said they will consider planting a perennial grass if a market develops in their area (n=17); 59% of respondents who indicated they are producers will consider using perennial grasses for nutrient management, erosion, or livestock production (n=17); and about 6% (n=17) currently contract to harvest stover or other biomass for bioenergy production.

B.

Changes in knowledge among 64 workshop participants were measured using pre-test and post-test evaluations. The results indicate a change in knowledge among 39% (n=25) of workshop participants that increasing grain drying temperature from 110 to 120 degrees F can increase energy efficiency by reducing total post-harvest fuel consumption. In addition, 28% (n=18) of participants indicated a change in awareness regarding the use early-maturing crop hybrids to maximize energy conservation by minimizing artificial drying of crop biomass and/or grain.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
131	Alternative Uses of Land
136	Conservation of Biological Diversity
402	Engineering Systems and Equipment
601	Economics of Agricultural Production and Farm Management

Outcome #3

1. Outcome Measures

Corn Stover Processing Research Creates New Enterprises

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
A supply chain was needed to move corn Stover - the stalks, leaves, husks and cobs left after grain harvest - to a new generation of plants that produce ethanol from plant cellulose. The supply chain for corn grain has developed since the 1800s, but moving bales of stover, a bulkier product, needed to be developed over just a few years to feed two ethanol plants opening in Iowa.

What has been done
Agricultural engineers worked with companies that are building cellulosic ethanol facilities. Iowa State researchers at the BioCentury Research Farm studied ways to grow and develop an industrial feedstock supply chain and achieve a high quality, economically viable product for biorefineries, while maintaining soil health and quality.

Project researchers developed supply chain training sessions and educated more than 70

employees of companies created to serve the supply chain. Training sessions focused on five distinct areas: windrowing equipment, baling equipment, managing biomass moisture, maximizing biomass quality and maximizing productivity logistics.

Results
For the 2013 corn stover harvest season the training meant $225,000 to the local new businesses engaged in feedstock collection.

The team also developed software and data analytics tools focused on providing real-time information to the 15-20 small businesses that are supporting the biomass supply chain in central Iowa. This information is located on an online web portal and provides instant access for each business to monitor machinery performance throughout the harvest season. It also focuses on providing key information to support decisions that each business will make throughout the harvest season to ensure they maintain profitability and continue to grow the biomass supply chain industry.

The process improvement training also led to a 4.5 percent increase in corn stover product density, which reduced the number of semi-trucks on Iowa roads by more than 1,200 a year.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
205	Plant Management Systems
402	Engineering Systems and Equipment
511	New and Improved Non-Food Products and Processes
601	Economics of Agricultural Production and Farm Management

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}