

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Sustainable Energy - new feedstocks and improved feedstock production

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
111	Conservation and Efficient Use of Water				25%
202	Plant Genetic Resources				50%
204	Plant Product Quality and Utility (Preharvest)				15%
511	New and Improved Non-Food Products and Processes				10%
	Total				100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	11.5
Actual Paid Professional	0.0	0.0	0.0	7.9
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
0	0	0	404606
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	404606
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	335475

V(D). Planned Program (Activity)

1. Brief description of the Activity

Disseminate research findings to the scientific community, stakeholders, agricultural, environmental, life science industries.
 Conduct agronomic and economic analysis.
 Recruit and train students, incorporating research training into teaching and extension curricula.
 Design and implement field and laboratory research.

2. Brief description of the target audience

State, local and federal agencies, small and limited-resource farmers, researchers, educators, policy makers, consumers and bioenergy companies.

3. How was eXtension used?

Worked as part of the leadership team for the Farm Energy CoP at eXtension.org.

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	150	6	5	0

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

Patent Applications Submitted

Year: 2012
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	2	1	3

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of workshops and presentations concerning new or alternative biofuel feedstocks.

Year	Actual
2012	4

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Increase in number of producers with knowledge of production options available for growing bioenergy feedstocks.
2	Increase in number of producers adopting production of bioenergy feedstocks.
3	Number of students receiving training in bioenergy production.
4	Number of protocols developed for mutagenesis and selection of herbicide resistant biofuel feedstock varieties.
5	Number of desirable biofuel feedstock varietal mutants recovered.
6	Number of new varieties of biofuel feedstocks developed.
7	Number of producers with knowledge of camellia as biofuel feed stock.
8	Number of new demonstration sites for camellia as alternative feedstock.
9	Number of camellia lines produced with enhanced fatty acid.
10	Number of producers in Tennessee growing camellia as biofuel feedstock.

Outcome #1

1. Outcome Measures

Increase in number of producers with knowledge of production options available for growing bioenergy feedstocks.

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	84

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Bioenergy, and biofuels in particular, are a mainstream concept as an alternative to the security and environmental issues related to fossil fuels. Many producers may be understandably skeptical about growing biofuel crops because of the lack of information available to them and the fact that there is currently no major market available for them to sell these products. However, it is important to disseminate this assistance to these producers because once the infrastructure and markets are fully established, producers will have the optimal tools available to them to succeed.

What has been done

Presentations on the use of switchgrass or native-warm season grasses for forage and bioenergy, small-scale biodiesel and potential oilseed feedstocks, and bioenergy in general were made at variety of local and regional events.

A statewide needs assessment concerning biofuel production techniques was conducted. Biofuel production fact sheets were developed.

A Twitter account (@TSUBioenergy) was setup and maintained to provide information on the bioenergy program at TSU as well as other bioenergy-related topics.

Obtained funding to build a mobile biodiesel production demonstration to bring biodiesel conversion equipment to farmers to show them how biodiesel is produced and the potential for producing biodiesel on the small-scale.

Worked as part of the leadership team for the Farm Energy CoP at eXtension.org.

Results

General increase in number of producers with interest and knowledge of bio-fuel production; 84% of respondents increased their knowledge of using native warm-season grasses for bioenergy, 85% of respondents increased their interest in using switchgrass for biofuel production.

4. Associated Knowledge Areas

KA Code **Knowledge Area**
511 New and Improved Non-Food Products and Processes

Outcome #2

1. Outcome Measures

Increase in number of producers adopting production of bioenergy feedstocks.

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Bioenergy, and biofuels in particular, are a mainstream concept as an alternative to the security and environmental issues related to fossil fuels. Many producers may be understandably skeptical about growing biofuel crops because of the lack of information available to them and the fact that there is currently no major market available for them to sell these products. It is important, however, to disseminate this assistance to these producers because once the infrastructure and markets are fully established, they will have the optimal tools available to them to succeed.

What has been done

Presentations on the use of switchgrass for forage and bioenergy were presented in a number of Tennessee counties.

A fact sheet was developed and published in conjunction with the University of Tennessee on improving switchgrass yields for bioenergy production.

Results

The project has not progressed far enough to measure grower adoption, nor have the commercial markets been established.

4. Associated Knowledge Areas

KA Code **Knowledge Area**
511 New and Improved Non-Food Products and Processes

Outcome #3

1. Outcome Measures

Number of students receiving training in bioenergy production.

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Bioenergy is a new, environmentally-focused field that encompasses a range of scientific disciplines. It has great impact on the environment due to its importance in maintaining the world's environmental and economic integrity. The U.S. has recently increased its focus in the area of bioenergy through federal mandates and funding for research, infrastructure and feedstock development, and education to enhance the nation's energy portfolio. This emphasis has created new opportunities in the 'green jobs' market which will require new efforts and new programs for training future professionals.

What has been done

Research has been conducted on optimal harvest timing of switchgrass for bioenergy production. This research has been performed with assistance from a graduate student. The research is part of the graduate student thesis.

Results

Switchgrass samples were harvested in the field by students and are currently being processed for analyses. Data from samples analyzed last year have been incorporated into a graduate student thesis for May 2013 graduation and future publication.

4. Associated Knowledge Areas

KA Code	Knowledge Area
511	New and Improved Non-Food Products and Processes

Outcome #4

1. Outcome Measures

Number of protocols developed for mutagenesis and selection of herbicide resistant biofuel feedstock varieties.

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Competition from weeds is one major cause for inferior switchgrass establishment under field conditions, presenting an increased risk and cost for the growers.

What has been done

We expect that the tetraploidy genome structure of 'Alamo' could be a reason for difficulty in screening mutant phenotypes in the M0 generation. We have obtained diploid foxtail millet seeds to continue the mutagenesis selection for herbicide sensitive or tolerance traits.

Results

One protocol for treating switchgrass 'Alamo' with sodium azide was developed.

4. Associated Knowledge Areas

KA Code	Knowledge Area
511	New and Improved Non-Food Products and Processes

Outcome #5

1. Outcome Measures

Number of desirable biofuel feedstock varietal mutants recovered.

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

New sources of genetic variation are needed for biofuel feed stocks. Genetic improvement of switchgrass may lead to increased sustainability of biofuel production.

What has been done

Seed stocks are treated with sodium azide and prepares for screening with different types of stresses to find more useful mutations.

Results

We have not identified any desirable phenotypes from the mutant population

4. Associated Knowledge Areas

KA Code	Knowledge Area
511	New and Improved Non-Food Products and Processes

Outcome #6

1. Outcome Measures

Number of new varieties of biofuel feedstocks developed.

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
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2012

1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Tolerance to environmental stress, including drought, salt and temperature stress, is a significant issue for biomass crop production.

What has been done

Testing of mutants for herbicide resistance and abiotic stress tolerance.

Results

One preliminary new line has been identified and is undergoing further testing.

4. Associated Knowledge Areas

KA Code	Knowledge Area
511	New and Improved Non-Food Products and Processes

Outcome #7

1. Outcome Measures

Number of producers with knowledge of camellia as biofuel feed stock.

Not Reporting on this Outcome Measure

Outcome #8

1. Outcome Measures

Number of new demonstration sites for camellia as alternative feedstock.

Not Reporting on this Outcome Measure

Outcome #9

1. Outcome Measures

Number of camellia lines produced with enhanced fatty acid.

Not Reporting on this Outcome Measure

Outcome #10

1. Outcome Measures

Number of producers in Tennessee growing camellia as biofuel feedstock.

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Many objectives in this project are on schedule for being met, notable results include:
84 producers have increased knowledge of production options available for growing bioenergy feedstocks.

One student has received training in bioenergy production.

Another protocol has been developed for mutagenesis and selection of herbicide resistant biofuel feedstock varieties.

However, the project has not progressed far enough to measure the increase in number of producers adopting production of bioenergy feedstocks.

Additionally, a relatively large number of objectives relating to the use of camellina a as biofuel feedstock will not be met due to the elimination of that priority in our Plan of Work.

Key Items of Evaluation