

**V(A). Planned Program (Summary)**

**Program # 2**

**1. Name of the Planned Program**

Sustainable Energy

**V(B). Program Knowledge Area(s)**

**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
133	Pollution Prevention and Mitigation				20%
201	Plant Genome, Genetics, and Genetic Mechanisms				10%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants				10%
302	Nutrient Utilization in Animals				10%
308	Improved Animal Products (Before Harvest)				20%
311	Animal Diseases				10%
403	Waste Disposal, Recycling, and Reuse				20%
	<b>Total</b>				100%

**V(C). Planned Program (Inputs)**

**1. Actual amount of FTE/SYs expended this Program**

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	3.2
Actual Paid Professional	0.0	0.0	0.0	6.3
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	275940
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	226449
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	57330

## V(D). Planned Program (Activity)

### 1. Brief description of the Activity

Scientists conducted research to:

- Better understand the dynamic genetic mechanisms that affect the health of hogs and thus influence production efficiency and quality of pork;
  - Compare the natural response to parasite exposure in sheep and goats through investigation of host infection status of sheep and goat rumen microflora and gene activation;
  - Develop a fermentation process to produce for bioethanol from biomass derived C5 and C6 sugars;
  - Identify microbial communities responsible for the Greenhouse gas emission and formulate strategies to reduce those emissions constructed wetlands;
    - To identify agronomic practices such as no tilling and winter cover cropping that effectively sequester carbon, increase soil stability and decrease soil erodibility;
    - Evaluate the effect/efficacies of the prebiotic factors of non-conventional feed ingredients on: digestibility and metabolism of nutrients of weaned pigs;
      - Investigate whether feeding synbiotic combination of yeast culture (YC) and oat to gestational and nursing sows positively influences the growth performance and gut health of their offspring;
      - Determine if swine facility dust contributes to porcine airway morphology differences in pigs raised indoors versus outdoors;
      - Explore the potential of *M. oleifera* as a treatment source for infection and inflammation and as a supplemental food source for promoting growth and health in livestock;
      - Investigate the potential of improving the efficiency of an established aseptic in vitro cultures protocol using seeds for germination of Alexandrian laurel;
      - Evaluate yield potential of different varieties of canola and sweet sorghum grown in Piedmont soils as sources of bio-fuel crops;
      - Assess use of biorational pesticides in the management of vegetable pests (cowpea, tomato, eggplant, collard greens) in small farms in North Carolina;
      - Investigate effects of nutrients, including carbon, nitrogen, and metal ions on production of alpha-galactosidase and beta-galactosidase enzymes;
      - Investigate the effects of various combinations of fungus (mushroom) myceliated grain supplementation on general health, fecal integrity, growth performance, foodborne pathogens (*Salmonella*, *Campylobacter jejuni*) and intestinal microbial profile in broiler chickens;
      - Analyze the growth and performance characteristics of heritage breed crossbred offspring to be raised in a hoop facility;
      - Determine the most effective combination of plant essential oils against foodborne pathogens in laboratory media and against human cancer cells in vitro;

- Identify outdoor shiitake mushroom strains for suitability for indoor cultivation and create new strains for commercial production;
- Compare vegetable production with or without high tunnels and whether near and far adjacent trees affect vegetable production with or without high tunnels;
- Assess the economic feasibility of producing switchgrass as biomass feedstock in North Carolina;
- Evaluate the interaction between polyphenols from grape pomace and major food ingredients and their impacts on the heat and pH stability of Muscadine polyphenols;
- Gave presentations at professional meetings and during various with Cooperative Extension programs
- Published findings in professional journals and in the Agricultural Research Program research magazine
- Seek patents for new discoveries
- Conducted tours, workshops and other activities to share findings with Extension educators and with companies that may commercialize products

**2. Brief description of the target audience**

- Companies involved in biotechnology applications
- Farmers involved in or considering producing agricultural products using biotechnology
- Consumers

**3. How was eXtension used?**

Extension was not used in this program

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	1245	347000	377	0

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

**Patent Applications Submitted**

Year: 2011

Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2011	Extension	Research	Total
<b>Actual</b>	0	16	16

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- # presentations at professional meetings

<b>Year</b>	<b>Actual</b>
2011	18

**Output #2**

**Output Measure**

- # media occurrences

<b>Year</b>	<b>Actual</b>
2011	7

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	# of licenses of current patents
2	# breakthroughs in new uses for biomass or other agricultural co-products in North Carolina
3	# improved plant production resulting from new propagation techniques
4	# technologies to prevent/treat animal diseases

## **Outcome #1**

### **1. Outcome Measures**

# of licenses of current patents

### **2. Associated Institution Types**

- 1890 Research

### **3a. Outcome Type:**

Change in Condition Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	0

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Develop commercially viable shiitake mushroom strains for indoor cultivation. 1. Screen shiitake mushroom strains from an existing culture collection for suitability in indoor cultivation. 2. Select the three best performing strains from Objective 1 to breed and develop shiitake strains with high market quality and high yield for commercial indoor cultivation. 3. Develop molecular markers for use in strain identification and license applications.

#### **What has been done**

Screen shiitake mushroom strains from an existing culture collection for suitability in indoor cultivation to select the best performing strains. Work has progressed on develop shiitake strains with high market quality and high yield for commercial indoor cultivation.

#### **Results**

Once the most promising strains are developed, molecular markers for use in strain identification will be identified and an application will be made to license this procedure.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
302	Nutrient Utilization in Animals
311	Animal Diseases
403	Waste Disposal, Recycling, and Reuse

## **Outcome #2**

### **1. Outcome Measures**

# breakthroughs in new uses for biomass or other agricultural co-products in North Carolina

### **2. Associated Institution Types**

- 1890 Research

### **3a. Outcome Type:**

Change in Condition Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	1

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

North Carolina ranks as the second largest hog farmer state in the country. Intensive confinement livestock farms produce large amounts of manure that need to be treated.

#### **What has been done**

A novel cattail to bioethanol process was successfully developed.

#### **Results**

Findings contribute to greater ethanol production in North Carolina, increased economic opportunities in rural areas, and reduction in US dependence on imported petroleum.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
133	Pollution Prevention and Mitigation
302	Nutrient Utilization in Animals
308	Improved Animal Products (Before Harvest)
403	Waste Disposal, Recycling, and Reuse

### **Outcome #3**

#### **1. Outcome Measures**

# improved plant production resulting from new propagation techniques

#### **2. Associated Institution Types**

- 1890 Research

#### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

#### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	0

#### **3c. Qualitative Outcome or Impact Statement**

##### **Issue (Who cares and Why)**

Outdoor pork production represents an important opportunity for small- scale, limited resources farmers across the state.

##### **What has been done**

This research has been extended to goats and has led to collaborative projects with other 1890 universities and Extension groups.

##### **Results**

The research will help small farmers to understand and apply best practices for production efficiency when raising hogs outdoors for animal welfare, and producers and consumer acceptance of pork productions systems.

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants

#### **Outcome #4**

##### **1. Outcome Measures**

# technologies to prevent/treat animal diseases

##### **2. Associated Institution Types**

- 1890 Research

##### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

##### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	0

##### **3c. Qualitative Outcome or Impact Statement**

###### **Issue (Who cares and Why)**

Concern has been expressed over the years that the continued use of sub-therapeutic levels of antibiotics in animal feed could increase the risk of transfer of drug-resistant pathogenic bacteria from animals to humans. This had led to a push to identify compounds that can reduce the sub-therapeutic use of in-feed antibiotics as growth promoters. Moringa oleifera is a tropical plant that contains a variety of phyto-chemicals that may have great potential as a source for non- antibiotic treatments for diseases like mastitis.

###### **What has been done**

Preliminary work has been done to determine the antimicrobial activities of Moringa oleifera extracts against methicillin-resistant Staphylococci isolated from bovine, clinical, and food sources. In addition, a pilot immune modulation study investigating the proliferation and differentiation of B and T lymphocytes exposed to Moringa in vivo and in vitro (using a mouse model) has been completed

###### **Results**

Sun dried Moringa leaves were pulverized to a fine homogeneous powder and used to prepare an extract using the Soxhlet method. Extracts were used to treat whole blood and isolated neutrophils from cows, sheep and goats (3 each). The effect of Moringa exposure on white blood cell differential counts, isolated neutrophil viability, RNA purity and concentration and secretion of cytokines was examined. Further, the immunomodulatory role in exposure to bacterial lipopolysaccharide or peptidoglycan was evaluated in isolated neutrophils. Analyses are underway to identify potential effects; refinement and replication of procedures are planned.

##### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
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311 Animal Diseases

#### **V(H). Planned Program (External Factors)**

##### **External factors which affected outcomes**

- Economy
- Public Policy changes
- Government Regulations

##### **Brief Explanation**

Based on a study designed to better understand the potential hazards associated with swine confinement facility dust new methods for characterization of airway morphology were developed. One method involving isolation and expansion of porcine tracheobronchial cells has developed and tested to the level that an application for invention disclosure has been initiated.

#### **V(I). Planned Program (Evaluation Studies)**

##### **Evaluation Results**

The range of work has shown promising progress in animal disease prevention/reduction in terms of identifying effective sources of diet supplementation, feeding practices that reduce reliance on antibiotics, and removal of environmental contaminants that stress and weaken immune systems. Research activities have led to several collaborative projects with other universities and organizations.

##### **Key Items of Evaluation**

Determination of impact includes the development of methods that are adopted that lead to prevention/treatment of animal disease, identification of promising preventive/treatment practices, and reduction of loss of animal production, and improve animal performance in the absence of illness/disease.