

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

#### Program # 1

##### 1. Name of the Planned Program

Global Food Security and Hunger

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			5%	5%
102	Soil, Plant, Water, Nutrient Relationships			5%	5%
111	Conservation and Efficient Use of Water			5%	5%
123	Management and Sustainability of Forest Resources			0%	5%
125	Agroforestry			0%	5%
132	Weather and Climate			5%	5%
201	Plant Genome, Genetics, and Genetic Mechanisms			5%	5%
202	Plant Genetic Resources			5%	5%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			5%	5%
205	Plant Management Systems			15%	15%
206	Basic Plant Biology			5%	0%
211	Insects, Mites, and Other Arthropods Affecting Plants			5%	5%
212	Pathogens and Nematodes Affecting Plants			5%	5%
213	Weeds Affecting Plants			2%	0%
216	Integrated Pest Management Systems			6%	5%
302	Nutrient Utilization in Animals			5%	15%
311	Animal Diseases			10%	5%
402	Engineering Systems and Equipment			5%	0%
502	New and Improved Food Products			2%	0%
601	Economics of Agricultural Production and Farm Management			5%	5%
	<b>Total</b>			100%	100%

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

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

**Auburn University**

Year: 2014	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	22.0	21.5
<b>Actual Paid</b>	0.0	0.0	43.3	0.0
<b>Actual Volunteer</b>	0.0	0.0	0.0	0.0

**Alabama A&M University**

Year: 2014	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	22.0	21.5
<b>Actual Paid</b>	0.0	0.0	0.0	17.6
<b>Actual Volunteer</b>	0.0	0.0	0.0	0.0

**Tuskegee University**

Year: 2014	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	22.0	21.5
<b>Actual Paid</b>	0.0	0.0	0.0	12.5
<b>Actual Volunteer</b>	0.0	0.0	0.0	0.0

**2. Institution Name:** Auburn University

**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	2891440	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	2891440	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

**2. Institution Name:** Alabama A&M University

**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	947395
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	1482851
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

**2. Institution Name:** Tuskegee University

**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	963688
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	885381
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

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

**1. Brief description of the Activity**

Research was conducted to understand the biology of plants and animals, understand their genome capacity and plasticity, understand genes controlling production and performance traits, and use such knowledge to develop new cultivars in plant production systems, improved animal and fish stocks, and develop management strategies. Research was conducted to develop improved production methods such as improved crop production systems; improved poultry and animal production systems, develop nutritional strategies in animal production systems. Research was also conducted to develop the best agricultural practices for growing crops and animals with minimal impact to the environment, lowest possible input, and maximal output. Examples include planting schemes, rotation, irrigation and water management, harvest, and post-harvest technologies, integrated pest and disease management systems for plants and animals, nutrition re-definition, management, feeding schemes, and other agricultural practices. Our objective goal was to conduct research to develop value-added foods, alternatives to pesticides and antibiotics to control disease outbreaks, and conduct economic analysis to increase profit

margins.

Research results were shared with extension personnel for further dissemination, particularly to county agents and producers. Additional dissemination of results were through direct contacts with farmers and producers (such as at field days and demonstrations, and commodity meetings), through publications (experiment station bulletins, on-line reports, press releases, as well as scientific journal articles), and include non-traditional efforts, such as working throughout communities and use of the Internet such as web sites, YouTube videos, iTunes, and other social media.

Research was conducted to develop more effective vaccines and other control methods to manage cattle, chicken, and fish diseases. The impact of Chlamydia spp. infections on calves and dairy cattle health and productivity was determined. These infections cause direct production losses by reducing fertility by > 28% and reducing milk production in dairy cattle by 5.1%. In addition, these diseases result in > 48% reduction in weight gain in calves. In a 3,700-head commercial dairy herd, these infections highly significantly reduced fertility after first timed artificial insemination of primiparous cows by 11.7% and total milk production from 1 to 205 days in milk by 5%.

Researchers are working to identify molecular mechanisms in an effort to design new effective therapies and vaccines against a wide variety of disease-causing organisms that affect both animals and plants. For example, a novel vaccine technology was developed to protect chickens against diverse infectious bronchitis virus (IBV). A recombinant Newcastle disease virus LaSota (rLS) expressing the more conserved IBV S2 gene (rLS/IBV.S2). Chickens were completely protected against IBV. These results demonstrate that over exposing the more conserved IBV S2 to the chicken immune system by means of a vectored vaccine, followed by boost with whole virus, provides broad protection against IBV.

Researchers continue to focus on identifying the molecular mechanisms that lead to the modulation of host cell responses to infection in an effort to design new and effective therapies and vaccines against *Toxoplasma gondii*, an obligate intercellular zoonotic parasite in sheep and other small ruminants. In other studies, researchers have identified bioactive substances in the pine bark that when added as a feed ingredient substantially reduced the internal parasite load in goats. These same bioactive natural products has proved toxic to a wide variety of insect pests.

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

Researchers, extension specialists, county agents, farmers and producers in the state, processors, students (both K-12 and at our institutions), all state citizens. 48,000 people are said to be directly involved in farming.

## **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
<b>Actual</b>	25000	111000	25000	135000

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

### Patent Applications Submitted

Year: 2014

Actual: 5

### Patents listed

- 1) MONOCLONAL ANTIBODY DETECTION KIT FOR AMBROSIA BEETLES;
- 2) Application of Pectin or Pectin-Derived Sugars to Enhance the Efficacy of Plant Growth Promotion and/or biological Control Due to Plant Growth-Promoting Rhizobacteria (PGPR)
- 3) Sunn Hemp Cultivars Capable of Producing Seed within the Continental United States
- 4) Novel Plant Attractants for Managing Yellowmargined Leaf Beetle, *Microtheca ochroloma* in Cruciferous Vegetables
- 5) Feed supplement products and methods of using such products for improved raising of ruminant livestock animals

## 3. Publications (Standard General Output Measure)

### Number of Peer Reviewed Publications

2014	Extension	Research	Total
<b>Actual</b>	11	425	436

### V(F). State Defined Outputs

#### Output Target

#### Output #1

##### Output Measure

- Peer reviewed publications

Year	Actual
2014	436

#### Output #2

##### Output Measure

- patent applications and disclosures

<b>Year</b>	<b>Actual</b>
2014	5

**Output #3**

**Output Measure**

- Products such as crop varieties, animal breeds, vaccines, methods developed and evaluated in Alabama best agricultural practices development and evaluations

<b>Year</b>	<b>Actual</b>
2014	10

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

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

O. No.	OUTCOME NAME
1	The long term target is to increase or to sustain agricultural production as measured by market value of agricultural products (2008 = \$4.67 billion). Program success will be indicated if market value of AL agricultural products stay level or increase. The short term outcome target will be the number of producers who are informed of the method developed, the varieties developed, or the best practices developed; The mid-term measure will be the number of farmers and producers adopting the methods, varieties, improved genetic stocks, or adopting the best agricultural practices.
2	Development of new variety of crops, new breeds of animals and stocks of poultry or aquaculture species
3	Development of technologies for control and management of plant diseases, pests, and animal diseases
4	Development and/or application of technologies, farming approaches, or organizational strategies that ensure the sustainability of rural communities and agricultural and forestry production systems.

## **Outcome #1**

### **1. Outcome Measures**

The long term target is to increase or to sustain agricultural production as measured by market value of agricultural products (2008 = \$4.67 billion). Program success will be indicated if market value of AL agricultural products stay level or increase. The short term outcome target will be the number of producers who are informed of the method developed, the varieties developed, or the best practices developed; The mid-term measure will be the number of farmers and producers adopting the methods, varieties, improved genetic stocks, or adopting the best agricultural practices.

Not Reporting on this Outcome Measure

## **Outcome #2**

### **1. Outcome Measures**

Development of new variety of crops, new breeds of animals and stocks of poultry or aquaculture species

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

- 1862 Research
- 1890 Research

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

Change in Knowledge Outcome Measure

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

<b>Year</b>	<b>Actual</b>
2014	2

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

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

Genetically modified animal stocks or plant varieties or new species need to be developed and applied to enhance production and profitability.

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

Methods for production of hybrid catfish were further refined to increase the efficiency of interspecific hybridization; new varieties of peanuts were tested to determine their characteristics for applications. Meat goat breeding program using Kiko and Boer goats was established.

#### **Results**

Efficiency for the production of hybrid catfish was increased. In the last year, over 25% of the catfish industry adopted hybrid catfish as the breeds that allowed more production, greater level of disease resistance, and more efficient feed conversion. Hybrids of Boer x Kiko goats are being tested for adaptability. Off-bottom oyster farming was proven to be economically viable. With Auburn University and partners, eight commercial oyster farms have been established in Alabama since 2010, with more than 12 acres in production. Since the aquaculture project began in 2010, over one million oysters have gone to market with a wholesale value of at least \$500,000, and this is expected to more than double in the coming year. The oyster farms have created at least six long-term, part-time jobs

#### 4. Associated Knowledge Areas

<b>KA Code</b>	<b>Knowledge Area</b>
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
206	Basic Plant Biology
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants

#### Outcome #3

##### 1. Outcome Measures

Development of technologies for control and management of plant diseases, pests, and animal diseases

##### 2. Associated Institution Types

- 1862 Research
- 1890 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

<b>Year</b>	<b>Actual</b>
2014	2

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

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

Plant diseases and pests cause major losses of production agriculture; animal diseases cause the largest losses to animal production industries.

**What has been done**

Research in characterization of vaccines have been conducted; new disease control measures were explored

**Results**

New vaccines against columnaris disease of catfish were developed and tested for their efficacy and efficiency. New biological control approaches have been developed for the control of plant nematode diseases. Construction and improvement of peanut genetic map. Development of molecular and biochemical pathways of resistance of *Haemonchus contortus* to anthelmintic drugs for possible vaccine development. Chicken meat and eggs are the most important protein source for human consumption worldwide. In 2014, part of our work focused on increasing resistance against avian infectious bronchitis virus (IBV). IBV continues to be the most common and economically important contributor to overall disease losses in poultry despite worldwide extensive vaccination with a multiplicity of type- specific vaccines. We developed recombinant vaccines expressing virus proteins relevant in the induction of immunity and protection. We have produced evidence that one of these proteins provides broad protection against IBV strains. We have patented this approach and are currently exploring opportunities with the industry to make this product commercially available. We believe that our discovery will eliminate the need of using multiple different vaccines to protect chicken populations against IBV. We developed a biological feed additive for the control of internal parasites in goats and other small ruminants. These methods will greatly reduce the use of antibiotics and other chemical forms of internal parasites of goats and other small ruminants. We molecularly identified all the races of *Fusarium oxysporum* f. sp. *vasinfectum* the causal agent of Fusarium wilt in Alabama and confirmed that we do not have the race 4 that has invaded California. This eliminated the potential need to quarantine cotton seed produced in Alabama.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
206	Basic Plant Biology
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems
311	Animal Diseases

## **Outcome #4**

### **1. Outcome Measures**

Development and/or application of technologies, farming approaches, or organizational strategies that ensure the sustainability of rural communities and agricultural and forestry production systems.

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

- 1862 Research
- 1890 Research

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

Change in Knowledge Outcome Measure

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

<b>Year</b>	<b>Actual</b>
2014	6

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

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

Agricultural practices need to be evaluated under the current condition to provide the best agricultural practices for production, sustainability, environment, and profit of the agricultural industries

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

A number of agricultural practices have been evaluated for their suitability under the current economic condition such as irrigation, rotation, fertilization, tillage, conservation, precision agriculture, organic agriculture animal nutrition, and disease management practices.

#### **Results**

A state irrigation bill was passed to assist Alabama farmers for adoption of irrigation for crop production. Farmers has begun to adopt the technology and investments have been made in AAES substations to provide research-based recommendations on variable rate irrigation. Precision agriculture techniques were extended to a number of farms to increase profitability. State wide training in organic agriculture production implemented to increase organic crop production and marketing in Alabama. System approaches for beef, pork, poultry, and aquaculture production were adopted to gain efficiency and effectiveness in agricultural production. Irrigation systems were adopted by small scale limited resource fruits and vegetable producers that have resulted in increased yield and income. A sustainable year-round grazing system for goats and other small ruminants was developed with training programs being carried out around the state.

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

<b>KA Code</b>	<b>Knowledge Area</b>
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
123	Management and Sustainability of Forest Resources
125	Agroforestry
132	Weather and Climate
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems
302	Nutrient Utilization in Animals
311	Animal Diseases
402	Engineering Systems and Equipment
502	New and Improved Food Products
601	Economics of Agricultural Production and Farm Management

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

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

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

##### **Brief Explanation**

Many factors affect global food security including the growth in human populations and irregular climate patterns. These factors and others are among the major threats to world food security.

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

##### **Evaluation Results**

This is the largest program in Alabama involving research in the development of new crop varieties, adoption of new seed and brood stocks, new animal breeds, development of best agricultural practices, and application of new technologies in a variety of areas ranging from integrated pest management to precision agriculture. Marked achievements were made in the last year. In particular, the evaluation of many germ plasm stocks that were developed elsewhere in Alabama allows adoption of genetic material in Alabama, enhancing productivity. The technologies involved in hybrid catfish production were improved. Now >25% of the industry is hybrid catfish. The application of hybrid catfish alone translates into multi-million dollars of economic gains per year. Major achievements were made in management of plant and animal diseases. In particular, vaccines were developed this last year against the major diseases in aquaculture. A vaccine against columnaris disease was developed that should be highly useful for the control of columnaris disease in catfish. New feed formulations for small ruminants were developed that substantially reduced the use of chemical drugs for the control of internal parasites of goats. New methods have been developed to control plant diseases. Field studies indicated that cotton treated with strobilurin or azoxystrobin fungicide against target spot disease at a cost of \$30/A results in yield increases of 100 to 300 lb lint/A, which translates into an income recovery of \$60 to \$180/A at the current world market price of \$0.60.

AAES researchers and ACES extension professionals worked with poultry producers to evaluate energy consumption and recommended retrofits for 130 Alabama poultry houses. The total value of energy saved to the poultry growers on these 130 houses is \$2 million per year.

### **Key Items of Evaluation**

The hybrid catfish is a major development. The application of the hybrid catfish by the entire industry is regarded to be revolutionary. In spite of the inability to produce sufficient numbers of hybrid catfish for the entire industry, now >25%-30% of the catfish industry uses hybrid catfish.