

**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%             |
| 125     | Agroforestry  |                 |                 | 0%             | 5%             |
| 132     | Weather and Climate   |                 |                 | 5%             | 5%             |
| 201     | Plant Genome, Genetics, and Genetic Mechanisms                    |                 |                 | 5%             | 5%             |
| 202     | Plant Genetic Resources   |                 |                 | 5%             | 10%            |
| 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

| Extension | Research |
|-----------|----------|
|           |          |

| Year: 2012               | 1862 | 1890 | 1862 | 1890 |
|--------------------------|------|------|------|------|
|                          | Plan | 0.0  | 0.0  | 22.0 |
| Actual Paid Professional | 0.0  | 0.0  | 29.0 | 21.5 |
| Actual Volunteer         | 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              | 1620000        | 0              |
| 1862 Matching       | 1890 Matching  | 1862 Matching  | 1890 Matching  |
| 0                   | 0              | 1620000        | 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              | 588540         |
| 1862 Matching       | 1890 Matching  | 1862 Matching  | 1890 Matching  |
| 0                   | 0              | 0              | 838366         |
| 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              | 723476         |
| 1862 Matching       | 1890 Matching  | 1862 Matching  | 1890 Matching  |
| 0                   | 0              | 0              | 693308         |
| 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 and improved animal and fish stocks.

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 conducted to develop the best agricultural practices for growing crops and animals with minimal impact to the environment, lowest possible of input, and the maximal amount of output. Some of the examples include planting schemes, rotation, irrigation, harvest, and post-harvest technologies, pest and disease control, nutrition re-definition, management, feeding schemes, and other agricultural practices.

Research was conducted to develop value-added food, alternatives to pesticides and antibiotics to control disease outbreaks, develop integrated pest and disease management systems for plants and animals, 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 may include non-traditional efforts, such as working through community and the use of the Internet such as web sites, YouTubes, itunes, and other social media.

Research was conducted to develop more effective vaccines to control chicken diseases.  
 Research was conducted to assess the impact of chlamydia infections on cattle health and productivity.

A study was conducted to understand and mitigate the economic impact of Chlamydia spp. infection in calves and dairy cows. This is important because chlamydiae are ubiquitous in cattle. Results showed that Chlamydia pecorum infections were detected in all 504 animals included in the study. These infections cause direct production losses by 28% reduction of fertility and 5.1% reduction in milk production in dairy cows, and 48% reduction in weight gain in calves. Measurement of plasma cholesterol, albumin, and globulin in conjunction with detection of chlamydiae (cervix in dairy cows, conjunctiva, vagina in

calves) and determination of anti-chlamydial IgM allows evaluation of direct (fertility) or indirect production losses (milk yield, weight gain in calves) caused by chlamydial infections via reduction of liver health. This information can be used to devise strategies for improving livestock productivity by reducing chlamydial infections.

Research was conducted by a team led by Dr. Kellye S. Joinerto identify factors that may make cows more susceptible to *T. fetus* infections, specifically interactions with the normal resident bacteria (commensals) in the vaginal cavity. Cattle production in the state of Alabama is a three billion dollar agricultural industry, and Alabama ranks 17th in the United States in total numbers of beef cows. It is critically important to protect this agricultural commodity and the economic viability of the Alabama cattle industry from diseases. *Tritrichomonas fetus* (*T. fetus*) is a prevalent reproductive disease that can negatively impact the cattle industry by causing low pregnancy rates and pregnancy losses. Interestingly, researchers have shown that increased numbers of commensal *Lactobacillus* species are present in healthy women and protects them from several sexually transmitted diseases. This team found an increased prevalence of *Bacillus* species commensals in infected herds, but rarely identified *Lactobacillus* species commensals in beef cows. Collectively, this suggests that *Lactobacillus* may play a role in disease prevention. Such discoveries may allow the identification and treatment of high-risk herds with *Lactobacillus* containing probiotics to increase pregnancy rates and decrease pregnancy losses.

Researchers are working to identify molecular mechanisms that lead to modulation of host cell responses to infection in an effort to design new effective therapies and vaccines against *Toxoplasma gondii*, an obligate intracellular zoonotic parasite in sheep and other small ruminants.

Researchers in molecular biology, disease diagnostics, and nutrition have teamed up to facilitate the development of probiotics to help protect fish from diseases.

New research has identified taurine as a key nutrient that is limiting the replacement of fishmeal in marine fish feed formulations. This key discovery will allow increased use of renewable plant based protein (e.g. US Soybeans) in marine fish feeds ensuring the continued expansion of commercial seafood production and the expansion of demand for plant proteins.

Reducing our reliance on fishmeal and improving the cost effectiveness of feeds is a top priority to the aquaculture industry. Auburn University was the first to develop plant based marine shrimp feeds and demonstrate them to the aquaculture industry.

A new probiotic has been identified that prevents growth of bacterial pathogens and shows positive efficacy in catfish and tilapia in preventing disease development and increasing survival. A patent is pending on the new technology and work with an industrial partner has begun to further research and marketing.

Researchers have identified key virulence properties in an emerging strain of *Aeromonas hydrophilia* that is responsible for the loss of approximately \$10 million of harvestable catfish. These studies have also shown that catfish are more susceptible to this emerging strain and show potential for vaccine development.

## **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 in the state are 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**

| 2012          | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|---------------|------------------------|--------------------------|-----------------------|-------------------------|
| <b>Actual</b> | 20000                  | 100000                   | 20000                 | 100000                  |

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

**Patent Applications Submitted**

Year: 2012

Actual: 2

**Patents listed**

- 1) Catenaria auxiliaris parasite of plant parasitic nematodes;
- 2) Development, characterization and early evaluation of new modified live vaccines against columnaris disease

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

**Number of Peer Reviewed Publications**

| 2012          | Extension | Research | Total |
|---------------|-----------|----------|-------|
| <b>Actual</b> | 10        | 400      | 410   |

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

**Output Target**

**Output #1**

**Output Measure**

- Publications

| Year | Actual |
|------|--------|
| 2012 | 410    |

**Output #2**

**Output Measure**

- patent applications

| <b>Year</b> | <b>Actual</b> |
|-------------|---------------|
| 2012        | 3             |

**Output #3**

**Output Measure**

- method and best agricultural practices development

| <b>Year</b> | <b>Actual</b> |
|-------------|---------------|
| 2012        | 6             |

**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> |
|-------------|---------------|
| 2012        | 2             |

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

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

Genetically modified animal stocks or plant varieties 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 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 being tested for adaptability

#### 4. Associated Knowledge Areas

| <b>KA Code</b> | <b>Knowledge Area</b>   |
|----------------|---|
| 102            | Soil, Plant, Water, Nutrient Relationships                        |
| 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  |
| 311            | Animal Diseases   |

#### 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> |
|-------------|---------------|
| 2012        | 2             |

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

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

Plant diseases, 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 2012 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.

## **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 Action Outcome Measure

### 3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2012 | 5      |

### 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 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. 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.

For instance, education efforts of Dr. Reed of the Entomology department have led to an IPM adoption rate of 80% by soybean growers with a savings of \$4/acre.

### 4. Associated Knowledge Areas

| KA Code | Knowledge Area  |
|---------|---|
| 101     | Appraisal of Soil Resources                                       |
| 102     | Soil, Plant, Water, Nutrient Relationships                        |
| 111     | Conservation and Efficient Use of Water                           |
| 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. Human population growth and the irregular climate patterns 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. Good achievements were made in the last year. In particular, the evaluation of many germplasm 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 over 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 methods have been developed to control plant diseases.

##### **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 over 25%-30% of the catfish industry uses hybrid catfish.