

# 2009 Alabama A&M University and Tuskegee University and Auburn University Combined Research Annual Report of Accomplishments and Results

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## I. Report Overview

### 1. Executive Summary

This report covers all three land grant universities of Alabama, i.e., Alabama A&M University, Auburn University, and Tuskegee University for the research activities, results, and accomplishments during the 2009 fiscal year. The three universities have distinct programs at each institution based on clientele needs, but the administrators of the Alabama Agricultural Research Program (AARP) work closely and cooperatively to enhance partnerships among our universities in all areas of research, education, and extension. The agricultural research programs of these universities have formed a partnership, the Alabama Agricultural Land-Grant Alliance (AALGA), to better address critical issues in food, agriculture, and natural resources in the state, region, and nation through multidisciplinary, multi-institutional, science-based teams that focus on the opportunities and the challenges facing farmers, consumers and agribusinesses. Working together, we have developed the priorities of AARP that included the following six areas of critical importance: (1) Enhancing agricultural production systems and value-added processing, which is realigned into a new program title of "Global Food Security and Hunger" for the FY 2011-2015 rolling five year plan; (2) food, nutrition, health and well-being, and agricultural biosecurity, which is realigned into a new program title of "Childhood Obesity" for the FY 2011-2015 rolling five year plan; (3) environment, ecosystems, and natural resources, which is realigned into a new program title of "Climate Change" for the FY 2011-2015 rolling five year plan; (4) bioenergy and bio-based economy, which is realigned into a new program title of "Sustainable energy" for the FY 2011-2015 rolling five year plan; (5) agricultural genomics and other basic agricultural research, which is merged into the new program of "Global Food Security and Hunger" for the FY 2011-2015 rolling five year plan; and (6) Industry-wide emerging issues. In recognition of the importance of international agriculture programs in promoting the competitiveness of U.S. agriculture in the global market place, AARP supports and participates in the efforts of international program offices in the three institutions. AALGA also seeks to provide quality education that prepares professionals for career opportunities in food, agriculture, environment, bioenergy, and natural resources in the state, the region, and the nation. Alabama's three land-grant universities have played key roles in the development of agricultural enterprises in Alabama. In 2009, good progress has been made. In particular, on the basis of major progress made in 2008 for the development of new varieties and crops, dissemination of information and applications of the new crop varieties has begun in 2009 with several specialty crops including seven chestnut varieties and two kiwifruit varieties. Release of these special crop varieties will have a major impact to the producers and consumers as they are superior in production and performance traits. In the area of food safety, the experiment stations of the three universities have been the major forces for research in securing our food. Auburn University started its AU Food Safety Initiative and is working to serve the nation as a "food safety hub" for the development of detection technologies, food safety testing, food safety education and training. The three universities are seriously engaged in Alabama Obesity Initiative to address the serious issue of obesity in the state. In spite of the uncertainty, research in the areas of climate change and bioenergy started to gain ground with more and more citizens becoming aware of the problem and engaged for the real change.

#### Total Actual Amount of professional FTEs/SYs for this State

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	6.9	0.0	88.4	65.0
Actual	0.0	0.0	92.4	72.5

## II. Merit Review Process

### 1. The Merit Review Process that was Employed for this year

- Internal University Panel
- Combined External and Internal University Panel
- Expert Peer Review

## 2. Brief Explanation

Internal merit evaluations were conducted on all existing projects by a panel of faculty, department heads/chairs and administrators as appropriate. Programs that encompass several projects, particularly those with identified funding sources (i.e., the AAES Hatch/Multistate Funding Program) were evaluated by an administrative panel to allocate continued funding.

Merits of new projects were evaluated by an expert panel composed of professionals from both within and out of state. In particular, experts from nearby universities such as University of Georgia, Mississippi State University, and Texas A&M University were selected to cover professional areas of all six research priorities. A balanced representation was considered for various internal units, basic sciences, applied sciences, and extension. The research proposals were reviewed by all expert panelists, and a panel meeting of two days was conducted at Auburn University. The combined internal/external expert panel ranked the proposals into categories of outstanding/highest priority for funding, excellent/high priority for funding, very good/high priority for funding, good/medium priority for funding, fair/low priority for funding, and poor/do not fund. The panel made its recommendations to the Director of AAES, and funding decisions were made based on the recommendations and the availability of funds. Our funding guidelines require leverage of extramural funding to increase the impact of Hatch funds.

## III. Stakeholder Input

### 1. Actions taken to seek stakeholder input that encouraged their participation

- Use of media to announce public meetings and listening sessions
- Targeted invitation to traditional stakeholder groups
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to selected individuals from general public
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals
- Survey of the general public

#### Brief explanation.

A number of stakeholder groups have previously been identified, and input was collected through regular meetings with discussion and feedback. In particular, AARP works closely with the 18 commodity groups through the Alabama Farmers Federation, the Alabama Cattlemen's Association, the Alabama Poultry and Egg Association, and other agricultural organizations. Commodity group committees were used to evaluate on-going research and new research proposals. Direct feedback to researchers and AARP administration was through projects that were funded and through discussion about new and emerging issues. Semi-annual meetings were held with various commodity groups. Administrators and faculty members regularly participate in commodity committee meetings and their semi-annual meetings.

### 2(A). A brief statement of the process that was used by the recipient institution to identify individuals and groups stakeholders and to collect input from them

#### 1. Method to identify individuals and groups

- Use Advisory Committees
- Use Internal Focus Groups
- Use External Focus Groups
- Open Listening Sessions
- Needs Assessments
- Use Surveys

#### Brief explanation.

Several groups have been established and are continuing, such as advisory committees that encompass producers and consumer groups. Surveys were conducted through various AAES newsletters, and input was

sought from the general public. The core stakeholders group is the commodity groups, agricultural organizations, producers, processors, market professionals, and consumers. However, as modern agricultural research are dealing with food, environment, natural resources, energy, food safety that are relevant to all citizens as well as the traditional agricultural production areas that are indirectly relevant to the general public.

**2(B). A brief statement of the process that was used by the recipient institution to identify individuals and groups who are stakeholders and to collect input from them**

**1. Methods for collecting Stakeholder Input**

- Meeting with traditional Stakeholder groups
- Survey of traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Survey of traditional Stakeholder individuals
- Meeting with the general public (open meeting advertised to all)
- Survey specifically with non-traditional individuals
- Survey of selected individuals from the general public

**Brief explanation.**

Several groups have been established and are continuing, such as advisory committees that encompass producers and consumer groups. Surveys were conducted through various AAES newsletters, and input was sought from the general public.

**3. A statement of how the input will be considered**

- In the Budget Process
- To Identify Emerging Issues
- Redirect Research Programs
- In the Staff Hiring Process
- In the Action Plans
- To Set Priorities

**Brief explanation.**

Input from stakeholders was used to set program priorities that are not only used for the distribution of research funds, but also for the hiring of new faculty and staff to meet the long term goals. Their input is also used to identify emerging issues relevant to agricultural needs. In a number of cases, research funds were redirected to address urgent and emerging agricultural issues identified by the agricultural industries.

**Brief Explanation of what you learned from your Stakeholders**

Water issues, both quantities and quality, are becoming more and more important. Even though Alabama received plenty of rain in 2009 after the historically severe drought during the previous several years in the southeastern US. Environmental issues in relation to agriculture are critical; energy security and long term supply is vital to the state's economy. The issues related to bioenergy are yet to be settled. The high demands of grains for bioenergy development have resulted in, at least in part, a huge hike in animal feed prices, which put the animal-based agricultural businesses such as the poultry industry, the catfish industry, and the dairy industry at a very difficult situation. The public is still wondering about the resolve of US government in dealing with its energy, thereby doubtful about the future of bioenergy. Issues related to climate change started to gain major attention, but continued government support of research in this area is essential for the long term mitigation of the impact of economic activities on climate change.

IV. Expenditure Summary

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

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	2347161

**Institution Name:** Auburn University

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	4402430	0

**Institution Name:** Tuskegee University

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	2328026

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

2. Total Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	0	0	0	2347161
Actual Matching	0	0	0	2347161
Actual All Other	0	0	0	0
Total Actual Expended	0	0	0	4694322

**Institution Name:** Auburn University

<b>2. Totaled Actual dollars from Planned Programs Inputs</b>				
<b>Extension</b>			<b>Research</b>	
	<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
<b>Actual Formula</b>	0	0	4402430	0
<b>Actual Matching</b>	0	0	4402430	0
<b>Actual All Other</b>	0	0	0	0
<b>Total Actual Expended</b>	0	0	8804860	0

**Institution Name:** Tuskegee University

<b>2. Totaled Actual dollars from Planned Programs Inputs</b>				
<b>Extension</b>			<b>Research</b>	
	<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
<b>Actual Formula</b>	0	0	0	2328026
<b>Actual Matching</b>	0	0	0	2328026
<b>Actual All Other</b>	0	0	0	0
<b>Total Actual Expended</b>	0	0	0	4656052

<b>3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from</b>				
<b>Carryover</b>	0	0	0	0

**V. Planned Program Table of Content**

<b>S. No.</b>	<b>PROGRAM NAME</b>
1	Enhancing Agricultural Production Systems, Value-Added Processing, and global Competitiveness
2	Food, Nutrition, Health and Well-being, and Agricultural Biosecurity
3	Sustaining Environment, Ecosystems, and Natural Resources
4	Supporting and enhancing economic opportunities and self-empowerment for families and communities
5	Bioenergy and Bio-based Economy
6	Agricultural Genomics and Other Basic Agricultural Research

**V(A). Planned Program (Summary)****Program # 1****1. Name of the Planned Program**

Enhancing Agricultural Production Systems, Value-Added Processing, and global Competitiveness

**V(B). Program Knowledge Area(s)****1. Program Knowledge Areas and Percentage**

<b>KA Code</b>	<b>Knowledge Area</b>	<b>%1862 Extension</b>	<b>%1890 Extension</b>	<b>%1862 Research</b>	<b>%1890 Research</b>
102	Soil, Plant, Water, Nutrient Relationships			5%	15%
111	Conservation and Efficient Use of Water			5%	0%
131	Alternative Uses of Land			2%	2%
132	Weather and Climate			5%	5%
136	Conservation of Biological Diversity			2%	2%
202	Plant Genetic Resources			5%	5%
204	Plant Product Quality and Utility (Preharvest)			2%	2%
205	Plant Management Systems			10%	10%
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			10%	10%
302	Nutrient Utilization in Animals			5%	12%
307	Animal Management Systems			10%	12%
311	Animal Diseases			5%	0%
402	Engineering Systems and Equipment			5%	0%
403	Waste Disposal, Recycling, and Reuse			7%	3%
502	New and Improved Food Products			5%	6%
601	Economics of Agricultural Production and Farm Management			5%	6%
	<b>Total</b>			100%	100%

**V(C). Planned Program (Inputs)****1. Actual amount of professional FTE/SYs expended this Program**

<b>Year: 2009</b>	<b>Extension</b>		<b>Research</b>	
	<b>1862</b>	<b>1890</b>	<b>1862</b>	<b>1890</b>
Plan	2.0	0.5	30.8	21.5
Actual	0.0	0.0	30.8	21.5

**2. Institution Name:** Auburn University**Actual dollars expended in this Program (includes Carryover Funds from previous years)**

Extension		Research	
<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
0	0	1402430	0
<b>1862 Matching</b>	<b>1890 Matching</b>	<b>1862 Matching</b>	<b>1890 Matching</b>
0	0	1402430	0
<b>1862 All Other</b>	<b>1890 All Other</b>	<b>1862 All Other</b>	<b>1890 All Other</b>
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	
<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
0	0	0	1036090
<b>1862 Matching</b>	<b>1890 Matching</b>	<b>1862 Matching</b>	<b>1890 Matching</b>
0	0	0	1036090
<b>1862 All Other</b>	<b>1890 All Other</b>	<b>1862 All Other</b>	<b>1890 All Other</b>
0	0	0	0

**2. Institution Name:** Tuskegee University

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

Extension		Research	
<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
0	0	0	681064
<b>1862 Matching</b>	<b>1890 Matching</b>	<b>1862 Matching</b>	<b>1890 Matching</b>
0	0	0	681064
<b>1862 All Other</b>	<b>1890 All Other</b>	<b>1862 All Other</b>	<b>1890 All Other</b>
0	0	0	0

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

**1. Brief description of the Activity**

Research was conducted to develop and test new plant varieties and new animal and fish breeds, to investigate improved production methods such as new pesticides and cultivars in plant production systems, to develop efficient integrated pest management strategies, and to develop nutritional strategies in animal production systems. Research was also conducted in newer areas to explore innovative means to generate energy, and to explore methods for mitigation of climate change. Economic analyses were conducted for various agricultural systems to increase profit margins and competitiveness of the US agriculture in the global economy.

Research results are shared with extension personnel for further dissemination, particularly to county agents and producers.

Additional dissemination of results are through direct grower contact (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 through non-traditional efforts such as working through community and the use of the Internet such as web sites, utubes, itunes, etc.

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

Researchers, extension specialists, county agents, producers (particularly those that are innovative), all producers in the state, students (both K-12 and at our institutions), all state citizens. In the state, 48,000 people are directly involved in farming, but a larger group, approximately 476,000 are involved in agriculture-related business.

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

**1. Standard output measures**

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Plan</b>	2000	12000	2000	8000
<b>Actual</b>	2000	14000	2000	10000

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

**Patent Applications Submitted**

Year: 2009  
 Plan: 1  
 Actual: 3

**Patents listed**

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

**Number of Peer Reviewed Publications**

2009	Extension	Research	Total
<b>Plan</b>	0	0	
<b>Actual</b>	0	182	202

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

**Output Target**

**Output #1**

**Output Measure**

- Publications

Year	Target	Actual
2009	80	182

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

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

O. No.	OUTCOME NAME
1	Market value of agricultural products (\$ billion) (2006 = \$5.29 B). Program success will be indicated if market value of AL ag products stay level or increase. (Medium term outcome)
2	Number of producers (ALFA cites 48,000, Apr. 2007). Program success will be reflected by little or no change in size of the population of producers. (Long-term)
3	Average producer age (2002 = 56.6). Program success will be indicated by declining or no change in the average producer age. (Long-term)

**Outcome #1**

**1. Outcome Measures**

Market value of agricultural products (\$ billion) (2006 = \$5.29 B). Program success will be indicated if market value of AL ag products stay level or increase. (Medium term outcome)

Not Reporting on this Outcome Measure

**Outcome #2**

**1. Outcome Measures**

Number of producers (ALFA cites 48,000, Apr. 2007). Program success will be reflected by little or no change in size of the population of producers. (Long-term)

**2. Associated Institution Types**

- 1862 Research
- 1890 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	47900	47900

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

**Issue (Who cares and Why)**

The numbers of citizens involved in farming is decreasing rapidly.

**What has been done**

Agricultural research and extension helped the profit margins of farmers.

**Results**

With increased profit margins, the numbers of farmers in Alabama remain stable.

**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
132	Weather and Climate
136	Conservation of Biological Diversity
202	Plant Genetic Resources

204	Plant Product Quality and Utility (Preharvest)
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
307	Animal Management Systems
311	Animal Diseases
402	Engineering Systems and Equipment
403	Waste Disposal, Recycling, and Reuse
502	New and Improved Food Products
601	Economics of Agricultural Production and Farm Management

### **Outcome #3**

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

Average producer age (2002 = 56.6). Program success will be indicated by declining or no change in the average producer age. (Long-term)

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

- 1862 Research
- 1890 Research

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

Change in Condition Outcome Measure

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

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2009	55	55

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

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

Aging of farmers

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

Agricultural education was strengthened.

##### **Results**

Some College of Agriculture graduates returned to farms, an encouraging sign.

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

**KA Code    Knowledge Area**

205	Plant Management Systems
216	Integrated Pest Management Systems
302	Nutrient Utilization in Animals
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**

Last year was a very wet year. Much rain in the Fall prevented harvest of soybeans and cotton from the fields that led to huge economic losses.

#### **V(I). Planned Program (Evaluation Studies and Data Collection)**

##### **1. Evaluation Studies Planned**

- Retrospective (post program)
- During (during program)

#### **Evaluation Results**

Good progress have been made in 2009. As agriculture in Alabama is adapting to global competition and changes due to bioenergy and climate change issues, research focus has been shifted to development of best agricultural practices.

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

Research in this program focused on development of best agricultural practices including utilization of superior genetic stocks and varieties, rotation, irrigation, precision agriculture, and non-tillage farming. For instance, we have developed new varieties of several specialty crops such as chestnuts, Satsuma mandarin, and kiwi fruits. Testing the performance of these new specialty crops are under way, and their utilization is expected to have a major economic impact. Rotation methods have been developed. For instance, rotation with Sunn hemp can have a major effect on reduction of nematode for other crops.

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

**Program # 2**

**1. Name of the Planned Program**

Food, Nutrition, Health and Well-being, and Agricultural Biosecurity

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

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
701	Nutrient Composition of Food			10%	15%
702	Requirements and Function of Nutrients and Other Food Components			10%	20%
703	Nutrition Education and Behavior			20%	25%
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources			30%	12%
721	Insects and Other Pests Affecting Humans			10%	0%
724	Healthy Lifestyle			20%	28%
<b>Total</b>				100%	100%

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

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

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	1.9	0.0	12.7	9.5
Actual	0.0	0.0	12.7	9.5

**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	600000	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	600000	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	
<b>Smith-Lever 3b &amp; 3c</b> 0	<b>1890 Extension</b> 0	<b>Hatch</b> 0	<b>Evans-Allen</b> 272983
<b>1862 Matching</b> 0	<b>1890 Matching</b> 0	<b>1862 Matching</b> 0	<b>1890 Matching</b> 272983
<b>1862 All Other</b> 0	<b>1890 All Other</b> 0	<b>1862 All Other</b> 0	<b>1890 All Other</b> 0

## 2. Institution Name: Tuskegee University

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

Extension		Research	
<b>Smith-Lever 3b &amp; 3c</b> 0	<b>1890 Extension</b> 0	<b>Hatch</b> 0	<b>Evans-Allen</b> 304081
<b>1862 Matching</b> 0	<b>1890 Matching</b> 0	<b>1862 Matching</b> 0	<b>1890 Matching</b> 304081
<b>1862 All Other</b> 0	<b>1890 All Other</b> 0	<b>1862 All Other</b> 0	<b>1890 All Other</b> 0

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

### 1. Brief description of the Activity

Research was conducted to determine nutrition and health relationships. Alabama is one of the most obese states in the nation, and much of this condition could be because of choices of food and lifestyle. Research was conducted to evaluate lifestyle habits (food choice, exercise, etc.) of citizens, evaluation of underlying reasons for these habits, program development for improvement, and measuring adoption of improved diets and activity levels.

Research is also conducted to produce healthier and safe food such as fruits and vegetables. In the area of food safety, technologies were developed for rapid detection of food borne diseases, and non-biological contaminants such as antibiotics.

Databases were established to secure agriculture and food in the face of bioterrorism. Such efforts focus on infectious agents of human diseases, but also include infectious diseases of animals and plants, including those of aquatic animals.

Research results are shared with extension personnel for further dissemination, particularly to county agents, consumers, and community leaders. Additional dissemination of results are through direct contact (such as survey participants and community gatherings), 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 faith-based groups.

### 2. Brief description of the target audience

All state citizens, particularly targeted groups of high-risk citizens. Students (K through 12; college groups). Food producers and marketers.

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

### 1. Standard output measures

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Plan</b>	2000	18000	3000	7000
<b>Actual</b>	5000	20000	4000	20000

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

**Patent Applications Submitted**

Year: 2009

Plan: 0

Actual: 0

**Patents listed**

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

**Number of Peer Reviewed Publications**

2009	Extension	Research	Total
<b>Plan</b>	0	8	
<b>Actual</b>	0	86	91

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

**Output Target**

**Output #1**

**Output Measure**

- publications

Year	Target	Actual
2009	10	86

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Decreased incidence of cases of food poisoning (AL state stats, % deaths from Salmonella and other intestinal infections in 2004 = 1.6%). Program success will be indicated by a decline or no change in this incidence. (Short-term outcome)
2	New technology(-ies) developed to monitor microbial contaminants. (Medium term outcome)
3	New professionals in workforce with training in food safety and security. (Long-term)

**Outcome #1**

**1. Outcome Measures**

Decreased incidence of cases of food poisoning (AL state stats, % deaths from Salmonella and other intestinal infections in 2004 = 1.6%). Program success will be indicated by a decline or no change in this incidence. (Short-term outcome)

**2. Associated Institution Types**

- 1862 Research
- 1890 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

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

**Issue (Who cares and Why)**

Food safety related incidents cause serious public health problems and cause huge economic losses.

**What has been done**

Research was conducted to develop rapid detection technologies;  
 Training and education sessions were conducted to disseminate knowledge, information, and technologies.

**Results**

Method of food safety detection have been developed;  
 Sensitive sensor-based technology have been developed.  
 Various food safety issues have been addressed through training and educational sessions. For instance, seafood evaluations found that unsaturated fatty acids are beneficial to human health; however, mercury contamination of seafood reduced this benefit. Research results was used to make a balanced recommendation of seafood consumption.  
 Alabama has one of the highest rates of obesity in the United States, and obesity is associated with increased risk of many other diseases. Identification of dietary patterns in other vulnerable populations such as the elderly and food insecure will assist in the development of evidence-based dietary recommendations specifically for these groups. Several new findings resulted from the studies conducted this past year are being used to develop intervention strategies to help college students avoid unhealthy changes in body weight, shape, and composition. Successful strategies for a worksite weight loss program were published by Gropper and coworkers.  
 Recommendations regarding weight loss goals for older adults were published by Zizza and colleagues. Such research results were used by practicing dietitians for dietary and physical activity recommendations for weight loss in obese older adults that minimize the likelihood of adverse effects on nutritional status.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components

- 703 Nutrition Education and Behavior
- 711 Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
- 721 Insects and Other Pests Affecting Humans
- 724 Healthy Lifestyle

**Outcome #2**

**1. Outcome Measures**

New technology(-ies) developed to monitor microbial contaminants. (Medium term outcome)

**2. Associated Institution Types**

- 1862 Research
- 1890 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

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

**Issue (Who cares and Why)**

Technology is lacking to rapidly detect biological contaminants in food.

**What has been done**

Research was conducted to develop sensor technology for rapid detection of foodborne diseases.

**Results**

Sensor technology developed by our Food Safety and Detection group is very sensitive for detection of foodborne diseases, and for tracing of food items.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
721	Insects and Other Pests Affecting Humans
724	Healthy Lifestyle

**Outcome #3**

**1. Outcome Measures**

New professionals in workforce with training in food safety and security. (Long-term)

**2. Associated Institution Types**

- 1862 Research
- 1890 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	17	17

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

**Issue (Who cares and Why)**

Working force need to be trained to address food safety related issues.

**What has been done**

Graduate and undergraduate students were trained.

**Results**

In addition to technology development in the food and food safety areas, training of students has been another major focus of this program. Auburn University has established a AU Food Safety Initiative. This Initiative is intended to serve as a food safety hub for the nation for research, training, and extension.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
721	Insects and Other Pests Affecting Humans
724	Healthy Lifestyle

## **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.)
- Other (catastrophic food poisoning)

### **Brief Explanation**

The economic crisis has had a negative impact on this program.

## **V(I). Planned Program (Evaluation Studies and Data Collection)**

### 1. Evaluation Studies Planned

- Retrospective (post program)
- During (during program)

## **Evaluation Results**

Good progress was made in the areas of food safety, nutrition and wellbeing, obesity, and agricultural biosecurity.

## **Key Items of Evaluation**

Alabama has initiated statewide efforts in fighting off obesity. Alabama Agricultural Research Program joined the effort and are a major research force for the studies of nutrition and childhood obesity.

Auburn University established an AU Food Safety Initiative that intends to become a national hub in food safety. The AU Food Safety Initiative is focused on development of food safety detection technologies, food safety testing, training, and education.

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

**Program # 3**

**1. Name of the Planned Program**

Sustaining Environment, Ecosystems, and Natural Resources

**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%	15%
111	Conservation and Efficient Use of Water			5%	2%
112	Watershed Protection and Management			5%	5%
125	Agroforestry			5%	15%
131	Alternative Uses of Land			5%	7%
132	Weather and Climate			20%	15%
133	Pollution Prevention and Mitigation			5%	5%
135	Aquatic and Terrestrial Wildlife			5%	2%
136	Conservation of Biological Diversity			5%	7%
141	Air Resource Protection and Management			10%	0%
216	Integrated Pest Management Systems			5%	10%
403	Waste Disposal, Recycling, and Reuse			10%	7%
405	Drainage and Irrigation Systems and Facilities			5%	0%
610	Domestic Policy Analysis			5%	5%
<b>Total</b>				100%	100%

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

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

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	3.0	0.0	22.1	11.5
Actual	0.0	0.0	22.1	11.5

**2. Institution Name:** Auburn University

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

Extension		Research	
<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
0	0	1200000	0
<b>1862 Matching</b>	<b>1890 Matching</b>	<b>1862 Matching</b>	<b>1890 Matching</b>
0	0	1200000	0
<b>1862 All Other</b>	<b>1890 All Other</b>	<b>1862 All Other</b>	<b>1890 All Other</b>
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	
<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
0	0	0	392502
<b>1862 Matching</b>	<b>1890 Matching</b>	<b>1862 Matching</b>	<b>1890 Matching</b>
0	0	0	392502
<b>1862 All Other</b>	<b>1890 All Other</b>	<b>1862 All Other</b>	<b>1890 All Other</b>
0	0	0	0

**2. Institution Name:** Tuskegee University

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

Extension		Research	
<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
0	0	0	190993
<b>1862 Matching</b>	<b>1890 Matching</b>	<b>1862 Matching</b>	<b>1890 Matching</b>
0	0	0	190993
<b>1862 All Other</b>	<b>1890 All Other</b>	<b>1862 All Other</b>	<b>1890 All Other</b>
0	0	0	0

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

**1. Brief description of the Activity**

Research was conducted to determine factors influencing our environment including best agricultural practices, managing agricultural wastes, promoting agro-tourism, analyzing land and water use patterns and resources, and reducing agricultural impact on climate change.

Research is also conducted to best conserve and utilize natural resources including forestry, water, ecosystems, fish and other aquatic resources, and biodiversity and various other issues of natural resource conservation and utilization.

In the past year, interest on climate change has drastically increased. Activities include: Evaluation of air pollution and global climate effects on terrestrial ecosystems; natural and semi-natural plant community responses (shifts in diversity) to air pollutants and global climate change; plant-stress-air pollution/global climate change interactions; air toxics, and urban ecology; establishing model systems for the use of symbionts and parasitic organisms as sentinels for global climate change and ecosystem functioning; assessment of potential climate change impacts on the Southeast's row crops based on historic extreme weather periods; assessment of farmers' level of knowledge on climate change, and types of information required to evaluate potential adaptation strategies, and preferred information delivery formats; determination of water availability and changes in freshwater; evaluation of influence of nursery and landscape practices on climate change; evaluation of carbon sequestration in ponds; assessment of impacts of changing climate variability on crop yields, agricultural insurance, agricultural loan performance, and policy design for carbon sequestration; evaluation of how changes in flows (due to climate-change driven changes in freshwater supply) affects movement of fishes along the Alabama River, and spawning migrations of paddlefish in the Tallapoosa River (and even their spawning success and eventual year-class strength or failure); evaluation of various fruit crops and cultivars best adapted to the climate change; evaluation of socioeconomic impacts of climate change; development of technologies and innovative crop management practices to reduce agriculture's energy footprint through improved water management, reduced pesticide and nutrient usage, and on-farm bioenergy production; evaluation of the effects of high CO2 on plant virus infection; evaluation of how nutritive quality of herbaceous vegetation for ruminant animals is affected by alterations in plant cell-wall composition and secondary chemistry resulting from exposure to phytotoxic concentrations of tropospheric (i.e., ground-level) ozone (O3).

Research results are shared with extension personnel for further dissemination, particularly to county agents, producers, industry leaders, policy-makers, citizens, and related federal agency personnel. Additional dissemination of results are through direct contact (such as demonstrations and community 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 faith-based groups.

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

Research community, producers, industry leaders, policy-makers, citizens, and related federal agency personnel.

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

**1. Standard output measures**

<b>2009</b>	<b>Direct Contacts Adults</b>	<b>Indirect Contacts Adults</b>	<b>Direct Contacts Youth</b>	<b>Indirect Contacts Youth</b>
<b>Plan</b>	1200	9000	300	900
<b>Actual</b>	1200	15000	300	3000

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

**Patent Applications Submitted**

Year: 2009  
 Plan: 0  
 Actual: 0

**Patents listed**

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

**Number of Peer Reviewed Publications**

<b>2009</b>	<b>Extension</b>	<b>Research</b>	<b>Total</b>
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<b>Plan</b>	0	0	
<b>Actual</b>	0	304	314

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

**Output Target**

**Output #1**

**Output Measure**

- publications

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2009	35	314

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

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

O. No.	OUTCOME NAME
1	Estimated tourism receipts = \$7.6 billion in 2005. Success of this program will result in maintenance or increase in revenue (medium term outcome).
2	Fish consumption advisories in sampled waters = 26 instances in 2004 (ADEM water board). Success of this program will result in decline of water contaminants that accumulate in fish, and consumption advisories will also subsequently decline. (Long-term outcome)
3	Incidence of ground water contamination of ~ 5000 sampled sites = 20% in 2002-2003. Success of this program will result in a decline of contaminant incidence (medium term outcome).

**Outcome #1**

**1. Outcome Measures**

Estimated tourism receipts = \$7.6 billion in 2005. Success of this program will result in maintenance or increase in revenue (medium term outcome).

Not Reporting on this Outcome Measure

**Outcome #2**

**1. Outcome Measures**

Fish consumption advisories in sampled waters = 26 instances in 2004 (ADEM water board). Success of this program will result in decline of water contaminants that accumulate in fish, and consumption advisories will also subsequently decline. (Long-term outcome)

**2. Associated Institution Types**

- 1862 Research
- 1890 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	24	12

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

**Issue (Who cares and Why)**

Contamination of aquatic environment causes advisories and thereby losing of revenue in tourism and fishing.

**What has been done**

Research was done to deal with environmental issues.

**Results**

Advisories were down much from previous levels. Partly the last year, we have had much rain that really help in cleaning up the environment contamination.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
135	Aquatic and Terrestrial Wildlife
403	Waste Disposal, Recycling, and Reuse

**Outcome #3**

**1. Outcome Measures**

Incidence of ground water contamination of ~ 5000 sampled sites = 20% in 2002-2003. Success of this program will result in a decline of contaminant incidence (medium term outcome).

**2. Associated Institution Types**

- 1862 Research
- 1890 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

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

**Issue (Who cares and Why)**

Water contamination was a serious issue in Alabama.

**What has been done**

Water research and water watch programs were carried out.

**Results**

Alabama Water Watch program is a good example and role model for the nation and the world in keeping water clean and safe. As a result of their research, extension, training, and testing, Alabama water is safe and clean.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
125	Agroforestry
133	Pollution Prevention and Mitigation
403	Waste Disposal, Recycling, and Reuse

## **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**

Natural forces can have a fundamental impact on environment and climate change that are well beyond human control.

## **V(I). Planned Program (Evaluation Studies and Data Collection)**

### **1. Evaluation Studies Planned**

- Retrospective (post program)
- During (during program)

## **Evaluation Results**

Good progress has been made in the areas of environmental studies, natural resource conservation and utilization, and climate change.

## **Key Items of Evaluation**

Water research is a leading research area in Alabama under this program. Water use and reuse, quantity and quality issues are becoming more and more important. The Water Resources Center at Auburn University is a hub of water research. Alabama Water Watch Program has been recognized by EPA to be a role model for the nation. The outreach programs of Alabama Water Watch have established similar Water Watch programs around the world.

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

**Program # 4**

**1. Name of the Planned Program**

Supporting and enhancing economic opportunities and self-empowerment for families and communities

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

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
134	Outdoor Recreation			10%	0%
802	Human Development and Family Well-Being			20%	20%
803	Sociological and Technological Change Affecting Individuals, Families, and Communities			10%	30%
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures			20%	10%
805	Community Institutions, Health, and Social Services			20%	10%
806	Youth Development			20%	30%
	<b>Total</b>			100%	100%

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

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

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	10.8	13.5
Actual	0.0	0.0	10.8	13.5

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	400000	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	400000	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	
<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
0	0	0	125468
<b>1862 Matching</b>	<b>1890 Matching</b>	<b>1862 Matching</b>	<b>1890 Matching</b>
0	0	0	125468
<b>1862 All Other</b>	<b>1890 All Other</b>	<b>1862 All Other</b>	<b>1890 All Other</b>
0	0	0	0

**2. Institution Name:** Tuskegee University**Actual dollars expended in this Program (includes Carryover Funds from previous years)**

Extension		Research	
<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
0	0	0	761335
<b>1862 Matching</b>	<b>1890 Matching</b>	<b>1862 Matching</b>	<b>1890 Matching</b>
0	0	0	761335
<b>1862 All Other</b>	<b>1890 All Other</b>	<b>1862 All Other</b>	<b>1890 All Other</b>
0	0	0	0

**V(D). Planned Program (Activity)****1. Brief description of the Activity**

Research was conducted to assess the impact of technological and sociological changes on family and communities; impact of family interactions on success of youth; availability and accessibility of health and social services to rural families and communities. Research results are shared with extension personnel for further dissemination, particularly to community leaders and educators and through leadership training. Additional dissemination of results are through direct contact (such as at school and community meetings), 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 faith-based groups.

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

Extension personnel, community leaders, educators, schools, students, 4H, youth centers, families and communities, and general public.

**V(E). Planned Program (Outputs)****1. Standard output measures**

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Plan</b>	1100	33000	900	3300
<b>Actual</b>	1100	33000	1500	10000

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

**Patent Applications Submitted**

Year: 2009

Plan: 0

Actual: 0

**Patents listed**

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

**Number of Peer Reviewed Publications**

2009	Extension	Research	Total
<b>Plan</b>	0	0	
<b>Actual</b>	0	22	32

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

**Output Target**

**Output #1**

**Output Measure**

- publications

Year	Target	Actual
2009	20	22

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	High school graduation rate (88.8% AL Dept. Educ. 2004-2005, from drop-out rate = 11.18%). Improvements in community and family integrity should increase this (medium term outcome).
2	Educational attainment (post secondary) (AL Dept Educ., Fall 2005, 55.8% of all high school graduates were enrolled in AL colleges). Success of this program should increase this (long-term outcome).
3	The number of small businesses should increase with success of this program. In 2001, US Bureau of Labor states that 229.7 (in thousands) 'non-employer' firms were existent in AL (medium term outcome).
4	AL Dept. Health notes that 4 of Alabama's 67 counties have fewer than 3 physicians per 10,000 residents. Success of this program should increase this (medium term outcome).

**Outcome #1**

**1. Outcome Measures**

High school graduation rate (88.8% AL Dept. Educ. 2004-2005, from drop-out rate = 11.18%). Improvements in community and family integrity should increase this (medium term outcome).

Not Reporting on this Outcome Measure

**Outcome #2**

**1. Outcome Measures**

Educational attainment (post secondary) (AL Dept Educ., Fall 2005, 55.8% of all high school graduates were enrolled in AL colleges). Success of this program should increase this (long-term outcome).

**2. Associated Institution Types**

- 1862 Research
- 1890 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	58	58

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

**Issue (Who cares and Why)**

Alabama high school graduation rate is very low, and percentage of students going to college is very low.

**What has been done**

Community education, and empowerment of families and various other activities were conducted.

**Results**

Alabama high school graduation rate has been among the most improved, but is still ranked low in the nation. More improvements needed.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions, Health, and Social Services
806	Youth Development

### **Outcome #3**

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

The number of small businesses should increase with success of this program. In 2001, US Bureau of Labor states that 229.7 (in thousands) 'non-employer' firms were existent in AL (medium term outcome).

Not Reporting on this Outcome Measure

### **Outcome #4**

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

AL Dept. Health notes that 4 of Alabama's 67 counties have fewer than 3 physicians per 10,000 residents. Success of this program should increase this (medium term outcome).

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
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

#### **Brief Explanation**

The economic down turn really had an enormous negative impact on the economic situation of families and communities in Alabama.

### **V(I). Planned Program (Evaluation Studies and Data Collection)**

#### **1. Evaluation Studies Planned**

- Retrospective (post program)
- During (during program)

### **Evaluation Results**

We have achieved much in assisting rural communities and empowering the families. Alabama Agricultural Research Program has worked closely with families and communities, particularly with under-represented and disadvantaged groups.

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

The economic crisis has affected rural communities in a big way. Auburn University researchers and extension specialists have helped several critical agricultural commodities to survive, thereby having a huge impact on communities and families. For instance, in the west Alabama Black Belt region, the major agricultural commodity is catfish. The catfish industry was under serious problems due to international competition, feed price increase, and energy and transportation cost increases. Auburn University initiated a pond to plate project that helped the industry, saved many jobs, and strengthened the communities and

families. Alabama A&M University and Tuskegee University have worked closely with minority families and communities, and helped the communities in these difficult times.

**V(A). Planned Program (Summary)****Program # 5****1. Name of the Planned Program**

Bioenergy and Bio-based Economy

**V(B). Program Knowledge Area(s)****1. Program Knowledge Areas and Percentage**

<b>KA Code</b>	<b>Knowledge Area</b>	<b>%1862 Extension</b>	<b>%1890 Extension</b>	<b>%1862 Research</b>	<b>%1890 Research</b>
102	Soil, Plant, Water, Nutrient Relationships			10%	15%
202	Plant Genetic Resources			10%	10%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			10%	10%
205	Plant Management Systems			20%	10%
212	Pathogens and Nematodes Affecting Plants			10%	10%
216	Integrated Pest Management Systems			10%	10%
402	Engineering Systems and Equipment			10%	5%
601	Economics of Agricultural Production and Farm Management			10%	15%
605	Natural Resource and Environmental Economics			5%	10%
607	Consumer Economics			5%	5%
	<b>Total</b>			100%	100%

**V(C). Planned Program (Inputs)****1. Actual amount of professional FTE/SYs expended this Program**

<b>Year: 2009</b>	<b>Extension</b>		<b>Research</b>	
	<b>1862</b>	<b>1890</b>	<b>1862</b>	<b>1890</b>
Plan	0.0	0.0	7.0	6.5
Actual	0.0	0.0	7.0	6.5

**2. Institution Name:** Auburn University**Actual dollars expended in this Program (includes Carryover Funds from previous years)**

Extension		Research	
<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
0	0	350000	0
<b>1862 Matching</b>	<b>1890 Matching</b>	<b>1862 Matching</b>	<b>1890 Matching</b>
0	0	350000	0
<b>1862 All Other</b>	<b>1890 All Other</b>	<b>1862 All Other</b>	<b>1890 All Other</b>
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	
<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
0	0	0	150008
<b>1862 Matching</b>	<b>1890 Matching</b>	<b>1862 Matching</b>	<b>1890 Matching</b>
0	0	0	150008
<b>1862 All Other</b>	<b>1890 All Other</b>	<b>1862 All Other</b>	<b>1890 All Other</b>
0	0	0	0

**2. Institution Name:** Tuskegee University

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

Extension		Research	
<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
0	0	0	172771
<b>1862 Matching</b>	<b>1890 Matching</b>	<b>1862 Matching</b>	<b>1890 Matching</b>
0	0	0	172771
<b>1862 All Other</b>	<b>1890 All Other</b>	<b>1862 All Other</b>	<b>1890 All Other</b>
0	0	0	0

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

**1. Brief description of the Activity**

Research activities included assessment of the productivity of different plant crops, alternative crops and forest such as switchgrasses, poplars trees, pine trees as well as algae for the production of biomass, production practices that influence the yield and production duration of these plants or algae, genetic or physiological improvements of such crops through breeding or biotechnology, and impact of bio-energy crops on agriculture in a broad spectrum of issues such as rotation, irrigation, water requirements, production and processing, environmental, economic, and social impact; development of technologies for efficient conversion of cellulose-based bio-energy; development of technologies for utilization of by-products and waste from bio-energy processing.

Development of new bioenergy crops such as Nelumbo or lotus as an alternative crop in the Blackbelt region which has, land, labor, the economic need, and ideal growing conditions for this crop. Lotus potentially meets the requirements for a bioenergy crop with its high biomass and high starch and does not compete currently for other uses. Research was also conducted to explore biodiesel production from algae. Quantifying the quality (BTU content) and quantity of energy from urban yard wastes that currently end up in the waste stream. We are developing a model to estimate the available biomass from urban areas based on remote sensing data and city zoning maps/data.

Research is underway on harvesting and transportation of biomass material for the alternative fuels industry, mostly centered on small diameter trees.

In collaboration with the College of Engineering, research was conducted for biomass conversion into biofuels based on thermochemical platform, for theoretical and experimental thermodynamic analyses of biomass gasification and feasibility studies of using chicken litter as partial substitute for wood chips with efforts directed towards reduction of ash temperature, and for designing optimal combinations of thermochemical and biochemical conversion processes for efficient transformation of cellulosic biomass into logistical fuels and chemicals. A major effort has been devoted to the development of technologies for bioenergy conversion with stable nanoscale colloidal suspensions within bio-derived oils that can be used for tribological applications (e.g. lubricating oils in machinery and transportation vehicles), electrochemical conversion of biofuels: Solid oxide fuel cells (SOFCs) have excellent fuel flexibility such that they can convert hydrocarbons, including reformed biofuels, directly (electrochemically) to electricity, which is much more efficient than conversion by combustion.

A systems biology approach was used to study the dynamic metabolic interactions between two different microbes, and attempt to address the hexose/pentose co-fermentation problem for lignocellulosic ethanol production.

Economic, and regulatory aspects of using large-scale renewable energy technologies to lower consumer costs, reduce environmental impact of energy production and consumption has been conducted, including calculating the minimum tariff on oil/gas imports to make bioenergy/renewable energy sources competitive, and economics and policy of joining carbon sequestration from improved forest management with tree-based biomass production for energy.

## 2. Brief description of the target audience

Researchers, scientific community, extension personnel, community leaders, educators, 4H, youth centers, energy consumers, general public.

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

#### 1. Standard output measures

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	1000	30000	1000	3000
Actual	1000	40000	1000	4000

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

##### Patent Applications Submitted

Year: 2009

Plan: 0

Actual: 0

#### Patents listed

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

##### Number of Peer Reviewed Publications

2009	Extension	Research	Total
Plan	0	0	

<b>Actual</b>	0	50	50
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**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Publications

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2009	{No Data Entered}	50

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Development of technology for production of bioenergy crops or algae leading to the increase of yields (ton per acre per year)
2	Publications
3	Increased acreage of bioenergy crops such as corn, switchgrasses
4	Increased percentage of bioenergy in the overall consumption of energy

**Outcome #1**

**1. Outcome Measures**

Development of technology for production of bioenergy crops or algae leading to the increase of yields (ton per acre per year)

**2. Associated Institution Types**

- 1862 Research
- 1890 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	7	0

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

**Issue (Who cares and Why)**

Bioenergy crops need to be identified, production technologies need to be developed, and best production practices need to be applied to increase yields per acre.

**What has been done**

Research was conducted to identify the varieties of switch grasses and other bioenergy crops.

**Results**

Several switch grasses have been identified as productive crops for bioenergy, along with pine trees naturally covering a large acreage of Alabama. Lotus is also being identified as a possibility that does not compete with land uses of food and feed crops. Utilization of agricultural and urban wastes as a source of bioenergy also shows promise.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems
402	Engineering Systems and Equipment
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics
607	Consumer Economics

## Outcome #2

### 1. Outcome Measures

Publications

### 2. Associated Institution Types

- 1862 Research
- 1890 Research

### 3a. Outcome Type:

Change in Knowledge Outcome Measure

### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	8	50

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Bioenergy is a new area of research, and much knowledge still need to be learned.

#### What has been done

Publications were made to provide information to make up the knowledge gap.

#### Results

Over 50 publications were generated in the last year in this area.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems
402	Engineering Systems and Equipment
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics
607	Consumer Economics

**Outcome #3**

**1. Outcome Measures**

Increased acreage of bioenergy crops such as corn, switchgrasses

**2. Associated Institution Types**

- 1862 Research
- 1890 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	20	20

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

**Issue (Who cares and Why)**

Corn and switchgrasses acreage need to be increased;

**What has been done**

Test plots of switch grasses were developed;

**Results**

More acreages of switchgrasses are involved.

Corn acreage was increased due to a higher economic return as a result of bioenergy demand.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems
402	Engineering Systems and Equipment

**Outcome #4**

**1. Outcome Measures**

Increased percentage of bioenergy in the overall consumption of energy

**2. Associated Institution Types**

- 1862 Research
- 1890 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	1	1

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

**Issue (Who cares and Why)**

Bioenergy need to be used to replace fossil energy.

**What has been done**

Alcohol, biodiesels and other forms of bioenergy was under development.

**Results**

There is promising trend in bioenergy research and development, but actual application of bioenergy await economic test.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
402	Engineering Systems and Equipment
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics
607	Consumer Economics

**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

**Brief Explanation**

All of the above factors can seriously affect research outcomes. We are concerned about the governmental persistence in bioenergy research. Oil prices can have a drastic impact on bioenergy research and applications.

**V(I). Planned Program (Evaluation Studies and Data Collection)**

## 1. Evaluation Studies Planned

- Retrospective (post program)
- During (during program)

### **Evaluation Results**

Research is on track for the development of bioenergy feed stock crops, the development of conversion technologies, and the development of best agricultural practices for bioenergy crops.

### **Key Items of Evaluation**

Government need to provide strong guide as to where energy policy of our country is going. Any lack of resolve may have very serious economic and social consequences.

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

**Program # 6**

**1. Name of the Planned Program**

Agricultural Genomics and Other Basic Agricultural Research

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

**1. Program Knowledge Areas and Percentage**

<b>KA Code</b>	<b>Knowledge Area</b>	<b>%1862 Extension</b>	<b>%1890 Extension</b>	<b>%1862 Research</b>	<b>%1890 Research</b>
201	Plant Genome, Genetics, and Genetic Mechanisms			10%	25%
202	Plant Genetic Resources			10%	25%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			10%	5%
206	Basic Plant Biology			10%	0%
303	Genetic Improvement of Animals			20%	20%
304	Animal Genome			20%	10%
305	Animal Physiological Processes			10%	15%
311	Animal Diseases			10%	0%
	<b>Total</b>			100%	100%

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

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

<b>Year: 2009</b>	<b>Extension</b>		<b>Research</b>	
	<b>1862</b>	<b>1890</b>	<b>1862</b>	<b>1890</b>
Plan	0.0	0.0	5.0	2.5
Actual	0.0	0.0	10.0	10.0

**2. Institution Name:** Auburn University

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

<b>Extension</b>		<b>Research</b>	
<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
0	0	450000	0
<b>1862 Matching</b>	<b>1890 Matching</b>	<b>1862 Matching</b>	<b>1890 Matching</b>
0	0	450000	0
<b>1862 All Other</b>	<b>1890 All Other</b>	<b>1862 All Other</b>	<b>1890 All Other</b>
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	370110
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	370110
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	217782
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	217782
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**

The impact of grafting on cold-responsive gene expression was studied in Satsuma mandarin (*Citrus unshiu*), *C. unshiu* grafted on *Poncirus trifoliata* rootstock and *P. trifoliata* following exposure to cold shock or cold acclimation treatments. Major changes in gene expression occurred in the different species during cold stress especially with respect to nitrate transporter, auxin responsive GH3, UDP-glycosyl transferase and chalcone-flavanone isomerase. The impact of rootstock on citrus scion during cold stress might be associated with partitioning of nutrients.

Progress has been made on the general examination of cytokinin regulatory factors in tomato. The complete genes of cytokinin regulatory factors have been obtained. Expression analysis are in progress to examine the cytokinin regulation of SICRF1,2,3, and 5 by real-time-PCR.

A large number of catfish ESTs were generated. This involve sequencing of over 30 cDNA libraries including normalize libraries. A total of 500,000 catfish ESTs are now available including approximately 330,000 channel catfish ESTs and 165,000 blue catfish ESTs. From these ESTs, a large number of single nucleotide polymorphism markers were identified.

An effort to integrate the majority of the CHORI-212 catfish physical map contigs to an expanded catfish linkage map is nearing completion. This effort included identification of BAC-end associated microsatellites from map contigs and genotyping them on a mapping panel of backcross hybrid progeny.

Molecular mechanisms of insecticide resistance was investigated. AeSCP-2 inhibitor-1 (SCPI-1) and inhibitor-2 (SCPI-2) against *Culex quinquefasciatus* were examined in insecticide resistant *Culex* mosquitoes. All of the resistant *Culex* mosquito strains exhibited similar sensitivity to SCPI-1 and SCPI-2 inhibitors compared with a susceptible S-Lab strain. When an AeSCP-2 inhibitor was applied simultaneously with permethrin, the toxicity of permethrin to the 2nd instar larvae of all 4 strains of *Culex* mosquitoes increased, suggesting a synergistic effect of AeSCP-2 inhibitors on the toxicity of permethrin against *Culex* mosquitoes. Both SCPI-1 and SCPI-2 caused a 2.4- to 3-fold reduction in permethrin resistance in HAmCqG9, suggesting that

the mode of action of the AeSCP-2 inhibitors may interfere with the mechanisms that govern permethrin resistance in the HAmCqG9 mosquito strain.

## 2. Brief description of the target audience

Research community, scientists, applied researchers, Extension personnel, community leaders, educators, 4H, youth centers, energy consumers, general public.

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

#### 1. Standard output measures

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Plan</b>	1000	30000	1000	3000
<b>Actual</b>	1300	30000	3000	3000

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

##### Patent Applications Submitted

Year: 2009

Plan: 0

Actual: 0

#### Patents listed

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

##### Number of Peer Reviewed Publications

2009	Extension	Research	Total
<b>Plan</b>	0	0	
<b>Actual</b>	0	15	17

### V(F). State Defined Outputs

#### Output Target

##### Output #1

###### Output Measure

- Publications

Year	Target	Actual
2009	5	40

##### Output #2

###### Output Measure

- Development of molecular markers

Year	Target	Actual
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2009 300 500

**Output #3**

**Output Measure**

- Increased genetic map resolution in the unit of centi-Morgans

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2009	10	10

**Output #4**

**Output Measure**

- Identification of traits linked markers for marker-assisted selection

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2009	1	0

**Output #5**

**Output Measure**

- Identification of traits linked markers for marker-assisted selection

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2009	10	0

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Publications
2	Development of molecular markers
3	Increased genetic map resolution in the unit of centi-Morgans
4	Identification of traits linked markers for marker-assisted selection
5	Characterization of genes of agricultural relevance

**Outcome #1**

**1. Outcome Measures**

Publications

**2. Associated Institution Types**

- 1862 Research
- 1890 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	10	0

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

**Issue (Who cares and Why)**

{No Data Entered}

**What has been done**

{No Data Entered}

**Results**

{No Data Entered}

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
303	Genetic Improvement of Animals
304	Animal Genome
311	Animal Diseases

**Outcome #2**

**1. Outcome Measures**

Development of molecular markers

**2. Associated Institution Types**

- 1862 Research
- 1890 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	300	0

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

**Issue (Who cares and Why)**

{No Data Entered}

**What has been done**

{No Data Entered}

**Results**

{No Data Entered}

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
303	Genetic Improvement of Animals
304	Animal Genome
311	Animal Diseases

**Outcome #3**

**1. Outcome Measures**

Increased genetic map resolution in the unit of centi-Morgans

**2. Associated Institution Types**

- 1862 Research
- 1890 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	10	0

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

**Issue (Who cares and Why)**

{No Data Entered}

**What has been done**

{No Data Entered}

**Results**

{No Data Entered}

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
303	Genetic Improvement of Animals
304	Animal Genome
311	Animal Diseases

**Outcome #4**

**1. Outcome Measures**

Identification of traits linked markers for marker-assisted selection

**2. Associated Institution Types**

- 1862 Research
- 1890 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	1	5

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

**Issue (Who cares and Why)**

Genomic research need to be translated into economic benefits.

**What has been done**

Research was conducted to provide translational possibilities.

**Results**

Markers linked to the traits were identified.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
303	Genetic Improvement of Animals
304	Animal Genome
311	Animal Diseases

**Outcome #5**

**1. Outcome Measures**

Characterization of genes of agricultural relevance

**2. Associated Institution Types**

- 1862 Research
- 1890 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	10	0

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

**Issue (Who cares and Why)**

Genes related to traits need to be characterized for utilization.

**What has been done**

Research was conducted to characterize phenotypic performance related genes.

**Results**

Characterization of traits-related genes allow their applications for genetic improvements or enhancements.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
303	Genetic Improvement of Animals
304	Animal Genome
311	Animal Diseases

#### 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

##### Brief Explanation

The economy really had some impact on the funding of the projects. Alabama agricultural research has been under funded.

#### V(I). Planned Program (Evaluation Studies and Data Collection)

##### 1. Evaluation Studies Planned

- Retrospective (post program)
- During (during program)

#### Evaluation Results

In spite of low funding, good progress has been made in this area.

#### Key Items of Evaluation

Fundamental research is key to scientific understanding of agricultural problems. Plant and animal genome research need to be given the largest attention as possible. Government should be persistently push the cause to the fruition.

Aquaculture genome research at Auburn University is leading the nation in genomics research. Researchers at Auburn has made genetic linkage maps, physical maps, identified markers related to performance traits, and obtained funds for whole genome sequencing of catfish.