

2012 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

Agriculture, forestry and related industries are a very significant sector of the Alabama's economy. Altogether, agricultural industries create over 580,000 jobs, i.e., one in every 4.7 jobs are related to agriculture. Agricultural industries contribute over 70 billion to the Alabama's economy. Therefore, research activities in support of such large and broad agricultural industries are diverse ranging from very basic, translational to highly applied research. Alabama also has three land grant universities. Therefore, we acknowledge that a complete report covering all these activities in the three land grant institutions may be difficult. This report, therefore, will provide only a sample of some highlights of research conducted in 2012. In addition, because research is a continuous process, and to provide a report so different from previous years is unrealistic.

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 2012 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, energy, environment, climate, natural resources, human health and wellbeing, and other agricultural issues 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) Global food security and hunger; (2) Climate Change including issues related to environment, ecosystems, and natural resources; 3. Food safety including nutrition, health and well-being, and agricultural biosecurity; 4. Childhood obesity; 5. Sustainable energy including bioenergy, bioproducts and bio-based economy; 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 activities 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. This report highlights some achievements made in 2012.

In the first program of Global Food Security and Hunger, continued research focused on evaluation and testing of various genetic stocks of plants and animals including various crops such as cotton, wheat, corn, pearl millet and peanuts, various horticultural crops such as vegetables, fruits and specialty crops, various animals including cattle, broilers, and catfish. Continued research also focused on development, refining, and adoption of agricultural best practices, economic analysis of the best agricultural practices under changed economic situation such as high costs of feed and energy as well as transportation. While many research projects are ongoing, the use of precision agriculture in Alabama led to savings for inputs of over \$22 million in 2012. Alabama poultry industries generate over two billion dollars annually, and savings made from the adoption of better insulated chicken houses have allowed savings to tens of million

dollars annually. Similarly, the industry share of hybrid catfish has increased to over 20%. The hybrid catfish made from the inter-specific hybridization of channel catfish female crossed with blue catfish male

exhibit superior traits in growth, resistance to diseases, feed conversion, and processing yields. Productivity and profits are estimated to be increased at least 20-30% because of the application of the hybrid catfish. Given that the catfish industry is a billion dollar industry, this technology alone can increase the catfish industry by over 100 million dollars a year. Dissemination of several specialty crops including seven chestnut varieties and two kiwifruit varieties has generated great economic impact as well. Work at Tuskegee University on the adaptability and marketability of ethnic Asian and African vegetable crops for production by limited resource farmers show very promising results.

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 established its AU Food Systems 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. In 2011, a \$6.5 million grant from FDA was awarded to Auburn to develop virtual training modules. Such grants will enhance food safety research in Alabama. Alabama A&M University is researching the survival and transmission of foodborne pathogens in certain plant models. Using pine bark as a feed additive, research at Tuskegee University has shown a reduction of internal parasites in goats thus drastically reduced the use of chemical drugs in the control of these parasites.

The three universities are seriously engaged in Alabama Obesity Initiative to address the serious issue of obesity in the state. Alabama is the second most obese state in the nation, and solutions must be generated from research, education, and extension programs. Alabama A&M University and Tuskegee University are leading efforts in obesity intervention in high risk families, particularly the underserved youth, using integrated approaches.

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. However, dealing with such major research issues, funding uncertainty is a serious problem. Two major teams involving researchers from Auburn University, Tuskegee University, and Alabama A&M University researchers were funded with a Bioenergy CAP grant, and the teams are making good progress. In the area of Climate Change, our researchers are working on selection of heat and stress tolerant germplasm with both plants and animals, but funding levels are yet very low.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	91.6	68.0
Actual	0.0	0.0	89.0	68.0

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, University of Florida 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 Associate Director of AAES, who works with staff of our financial office to determine the funding and funding levels, based on the panel recommendations and the availability of funds. A final recommendation was made by the Associate Director to the Director of AAES, and funding decisions made. At Alabama A&M University, call for proposals was issued by the Dean and Research Director. Proposals submitted were sent to a panel of reviewers for review, ranking and recommendations. The final recommendation and funding decisions was made by the Dean and Research Director. In all cases, accountabilities were built into the programs. The RFP requires leverage of extramural funding to increase the impact of formula funds. After completion of the first phase of seeds funding, the principle investigators must provide a section of "Results from Previous Funding" that include the leverage of extramural funding, research publications, products, patents, and methods. The evaluation panel will determine if the seeds funding was used effectively in leveraging funds and in generating research output, both quantities and qualities. Lack of leverage and lack of significant research output alone is enough reason not to continue funding. At Tuskegee University, call for proposals is usually issued by the Dean and Director. All proposals are required to be multidisciplinary and integrative and must address critical need areas based on USDA's priority and challenge areas. Proposals are initially reviewed by an internal panel. Selected proposals are corrected based on the reviewers' comments and then sent out for external reviews. Corrected final proposals are submitted to USDA/NIFA for approval.

Similarly, with AALGA funding, the AALGA Deans of agriculture and Associate Deans for research set the funding priority areas, and the AALGA funds were distributed based on a competitive process. The proposals were peer-reviewed, and funding recommendations were made. One of the strengths of the AALGA funded projects is that AALGA requires collaboration from all three AALGA universities that enhances multi-institutional collaborations.

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.

Input was collected through regular meetings with discussion and feedback from various stakeholders groups. 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 discussions 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 and cooperatives, producers, processors, market professionals, and consumers. However, as modern agricultural research deals with food, environment, natural resources, energy, food safety and human health 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)
- Meeting specifically with non-traditional groups
- Meeting 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.

The AARP administrators take the stakeholders input very seriously. 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. The input from stakeholders was also considered during strategic planning and whenever relevant, put into the action plans as well.

Brief Explanation of what you learned from your Stakeholders

The overall agricultural and food systems has been evolving. As a result, agricultural conditions have changed dramatically in the last decades. The best agricultural practices need to be reevaluated and validated for the changed situation, but yet funding does not exist for such research. Obesity and chronic diseases are very prevalent in rural communities particularly minority populations and require nutrition and health education programs to address these issues. Agricultural research, education, and extension labor force is becoming smaller and smaller to reach a critical mass limit that may adversely impact agricultural research, education and extension. For instance, we can no longer fill positions that are crucially important due to budget cuts.

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	2624247

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	5017558	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	2605127

Institution Name: Alabama A&M University

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	0	0	0	1664236
Actual Matching	0	0	0	2533000
Actual All Other	0	0	0	0
Total Actual Expended	0	0	0	4197236

Institution Name: Auburn University

2. Totaled Actual dollars from Planned Programs Inputs				
Extension			Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	0	0	5150380	0
Actual Matching	0	0	5150380	0
Actual All Other	0	0	0	0
Total Actual Expended	0	0	10300760	0

Institution Name: Tuskegee University

2. Totaled Actual dollars from Planned Programs Inputs				
Extension			Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	0	0	0	2307517
Actual Matching	0	0	0	2211299
Actual All Other	0	0	0	0
Total Actual Expended	0	0	0	4518816

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	0	0	0	0

V. Planned Program Table of Content

S. No.	PROGRAM NAME
1	Global Food Security and Hunger
2	Climate Change
3	Food Safety
4	Childhood Obesity
5	Sustainable Energy

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%
	Total			100%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Extension	Research

Year: 2012	1862	1890	1862	1890
	0.0	0.0	22.0	21.5
Plan	0.0	0.0	29.0	21.5
Actual Paid Professional	0.0	0.0	0.0	0.0
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

2012 Alabama A&M University and Tuskegee University and Auburn University Combined Research Annual Report of Accomplishments and Results 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
Actual	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
Actual	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

Year	Actual
2012	3

Output #3

Output Measure

- method and best agricultural practices development

Year	Actual
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

Year	Actual
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

KA Code	Knowledge Area
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

Year	Actual
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

KA Code	Knowledge Area
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.

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Climate Change

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
102	Soil, Plant, Water, Nutrient Relationships			10%	5%
111	Conservation and Efficient Use of Water			10%	5%
112	Watershed Protection and Management			5%	15%
123	Management and Sustainability of Forest Resources			5%	5%
125	Agroforestry			5%	5%
131	Alternative Uses of Land			5%	5%
132	Weather and Climate			10%	10%
133	Pollution Prevention and Mitigation			10%	10%
135	Aquatic and Terrestrial Wildlife			5%	5%
201	Plant Genome, Genetics, and Genetic Mechanisms			5%	5%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			5%	5%
304	Animal Genome			5%	5%
403	Waste Disposal, Recycling, and Reuse			10%	10%
610	Domestic Policy Analysis			5%	5%
903	Communication, Education, and Information Delivery			5%	5%
	Total			100%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	20.0	12.0
Actual Paid Professional	0.0	0.0	22.0	12.0
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	1232000	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	1232000	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	541791
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	806682
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	321187
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	307890
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

Although this program was named Climate Change, the program was expanded to include environment, natural resources, and ecosystems.

Research was conducted to develop sustainable agricultural systems emphasizing energy and resource conservation; improve understanding of the land-water interface and the urban-agriculture interface; contribute to solutions to the consequences of global climate change; provide a framework for understanding and addressing issues of water quality and quantity, water reuse, carbon sequestration, air quality, and seek economically viable practices for improved sustainability in large- and small-scale agriculture; management of agricultural waste and residues generated through the animal and poultry and crop production systems; sustainable agriculture systems to enhance soil productivity and improve water infiltration and the plant-root environment; ecotourism; invasive species; soil conservation, quality, and bio-indicators; rural-urban interface and environmental issues; wildlife management; restoration and best management practices; remote sensing and precision agriculture; and science-based policy development. This priority is aligned with the USDA research priority area of Climate Change with Alabama's long-term goal of best conserving and utilizing natural resources while sustaining the environment.

Auburn University was awarded \$1.8 million from the U.S. Department of Defense to help develop a plan for sequestering carbon in longleaf pine forests on military bases - thus reducing the amount in the atmosphere. Professor Lisa Samuelson, director of the Center for Longleaf Pine Ecosystems in Auburn's School of Forestry and Wildlife Sciences, will lead the project that includes as collaborators the USDA Forest Service's Southern Research Station and the University of Florida. The overall grant for the study is \$2.4 million. The project, "Developing Tools for Ecological Forestry and Carbon Management in Longleaf Pine," is funded by the Department of Defense's Strategic Environmental Research and Development Program. This is the first year of the study.

Some of the highlights of activities include studies of ozone exposed forage in relation to nutritional values to beef cattle, analysis of effects and implications of agronomic practices on soil fertility and environmental quality in Alabama, development of regional curves or hydraulic geometry relationships of streams in the Alabama Appalachian Plateau that includes in-stream biota response and documentation of floodplain vegetation assemblages and soil characterization, development of management practices for the biological component of soil, analysis of how crop rotations influence carbon (C) and nitrogen (N) amounts in the soil, and its impact on soil C sequestration and N availability for plant growth, analysis of the impact of variable-rate application of nutrients in Alabama and distribution and successful implementation of nutrient management planning, development of techniques for vegetation establishment and management on steep slopes of construction sites to provide erosion control and minimize off-site impacts, modeling for TMDL development, and watershed based planning, management and assessment, application of precision agriculture technologies or improved crop production in the Tennessee Valley, development of systems for controlling air pollutant emissions and indoor environments of poultry, swine, and dairy facilities, development of nutritional and management abatement strategies for improvement of poultry air and water quality, and development of strategies for carbon sequestration and greenhouse gas emission reduction in horticultural production practices.

Long term studies being conducted to evaluate the effect of land use on soil and water quality in two watersheds in the Alabama River basins, the Catoma creek and Mulbarry Creek watersheds. Using PLOAD method, the results show that both watersheds had total Nitrogen and total Phosphorus values exceeded the EPS' limits for rivers and streams.

Studies are being conducted at Alabama A&M University for a better understanding of the processes responsible for the development of redoximorphic features in soil, and to improve our knowledge to use such soil features as well as climatic data to identify flood vulnerable soils.

A study was conducted to quantify potential interactions (positive and negative) between introduced yellow perch and resident sport fishes in two lake ecosystems (Lake Martin and Yates Lake). Results indicated that negative effects from competition were essentially nonexistent, while yellow perch actually provided potential positive effects as prey for piscivores during a short time in the spring. As an introduced member of these lakes, they are likely having neutral to positive effects, and in Yates Lake, and small fishery may be established for them.

A comprehensive study of eight years was conducted to assess ecosystems interactions of largemouth bass in the Mobile-Tensaw Delta of Alabama that face a complex set of challenges and advantages in the coastal environment. Salinity can represent a stressor for freshwater fish, but the diversity of prey that can be found in low salinity waters is actually beneficial for young bass. It was found that largemouth bass in the Delta live shorter lives and reproduce earlier in life than their freshwater counterparts.

2. Brief description of the target audience

Farmers, producers, land owners, industry leaders, policy-makers, citizens, and related state and federal agency personnel.

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
Actual	10000	50000	20000	100000

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

Patent Applications Submitted

Year: 2012

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	10	260	270

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- publications

Year	Actual
2012	270

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Reduced carbon footprint by adopting improved agricultural practices
2	Increased carbon sequestration by adoption of technologies and improved agricultural practices.
3	Identification of crop varieties and animal stocks that can adapt to a changing environment.

Outcome #1

1. Outcome Measures

Reduced carbon footprint by adopting improved agricultural practices

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Increased carbon sequestration by adoption of technologies and improved agricultural practices.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Identification of crop varieties and animal stocks that can adapt to a changing environment.

2. Associated Institution Types

- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Crop varieties and animal breeds more adaptable to elevated temperature need to be developed in the face of climate change and extreme weather.

What has been done

Breeding work was conducted to select for drought and high temperature resistant cotton and peanut varieties;
Initial gene expression work was conducted to assess molecular responses of catfish to elevated

temperature.

Breeding work was conducted to select sweet potato varieties adaptable to drought conditions

Results

Not achieved to the new varieties yet, but progress are being made to have drought resistant peanut varieties;

Many genes are identified as the response genes to heat in catfish, and further analysis of associated genome markers are underway.

Selection of drought tolerant sweet potato varieties have been selected for further field testing

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
304	Animal Genome
403	Waste Disposal, Recycling, and Reuse
903	Communication, Education, and Information Delivery

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

V(I). Planned Program (Evaluation Studies)

Evaluation Results

This program was named climate change (and starting this year, to be changed to Natural resources, environment sustainability and climate change) covers a broad range of research activities. It is the second largest program. Researchers work in the areas of natural resource conservation, management and utilization, environmental sciences, and

climate change. This is perhaps the most active research area in Alabama under the umbrella of AAES and AALGA.

We have many different research projects under this area with traditional environmental research and the more climate change oriented projects. Overall, research is very active in this area. Our recent research summary in the retreat indicated that we have the largest number of faculty who works in this area.

Key Items of Evaluation

To be prepared for a changing climate, greater funding opportunities are essential. In spite of the very active research in this area in Alabama, funds are limited.

NIFA should have long term sustainable funding in this area. It may seem to be remote, but climate is quietly changing. If we are not prepared, climate change may threaten the very existence of the human kind.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Food Safety

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
304	Animal Genome			10%	10%
307	Animal Management Systems			10%	15%
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals			10%	0%
501	New and Improved Food Processing Technologies			20%	20%
503	Quality Maintenance in Storing and Marketing Food Products			10%	10%
504	Home and Commercial Food Service			5%	5%
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources			10%	15%
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins			20%	20%
723	Hazards to Human Health and Safety			5%	5%
	Total			100%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	13.0	8.0
Actual Paid Professional	0.0	0.0	14.0	8.0
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	784000	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	784000	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	209485
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	343241
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	280776
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	269153
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

Specific areas of research include, but are not limited to: reduce the incidence of food-borne illness and provide a safer food supply; eliminating causes of microbial contamination and antimicrobial resistance; educating consumer and food safety professionals; developing food processing technologies to improve food safety; development of technologies for tracing the sources of food production; development of technologies for rapid analysis and identification of food including seafood; development of technologies for rapid detection of biological and chemical contamination such as antibiotics, pesticides, and other contaminants. This priority is aligned with the USDA research priority area of Food Safety and with the needs of Alabama to ensure the safety and wellbeing of its citizens, and with the economic interest of Alabama in the global economy. Alabama A&M University is undertaking studies on the survival and transmission of foodborne pathogen in some plant models.

In 2012, AU Food Safety Initiative became the officially recognized institute, AU Food Systems Institute. This institute has been extremely active in integrating all research, education, and outreach activities in food safety and food systems. Here is a few highlights:

AUFSI works with the university's world-renowned aquaculture program, the National Center for Asphalt Technology, the Detection and Food Safety Center, and even the Auburn University hotel and restaurant program to address food system concerns. Communicating researchers' food-related findings through proper training and outreach are also part of AUFSI's plan. AUFSI strives to maximize Auburn's existing internal strengths in the food systems arena as well as facilitate external collaborations with industry and government agencies.

The Auburn University Food System Institute organized the core faculty who are a part of working groups consisting of researchers from different disciplines. These core faculty members share common interests pertinent to food systems and communicate their respective research to one another. In 2012, AUFSI added eight new core faculty members from varied disciplines such as geology, agricultural economics, supply chain management, public relations, and biosystems engineering. Some of highlights of AU Food Systems Institute include:

- Established Virtual Food Systems Training Consortium (VFSTC) Advisory Board;
 - Established IACET (International Association for Continuing Education and Training) committee to complete accreditation process for AUFSI to become IACET provider;
 - Established partnerships with three universities through collaborative grant efforts;
 - Expanded core faculty membership, who attended and/or presented at 13 conferences (ranging from regional to international) and established HAACP, AFDO, and AF-DOSS connections;
 - Established social networking avenues: web page, Twitter, Facebook;
 - Developed training needs assessment and administered assessment to state inspectors in four states;
 - Became partner in FDA-approved lab and entrepreneur food-testing lab;
- Studies at Tuskegee University are being conducted to identify weak strains of Salmonella that can be used as possible vaccine candidates against salmonella infections.

2. Brief description of the target audience

Researchers, educators, producers, food processors, super markets, consumers, and the general public.

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
Actual	30000	150000	50000	200000

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

Patent Applications Submitted

Year: 2012

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	5	110	115

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Publications

Year	Actual
2012	115

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.
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.

Not Reporting on this Outcome Measure

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 Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

New technologies for food safety is needed to ensure that our food is safe;
Effective education need to be conducted with the genral public and citizens of the state to allow them to understand food safety related issues and procedures to reduce food poisoning and food-related illness.
Technologies need to be transferred to increase the level of food safety and detection of food related sources of infection or incidents.

What has been done

Auburn University has established an Institute of Food Systems. This institute was established on the basis of the AU Food Safety Initiative.
Food Systems faculty was established to conduct more effective education, research, and outreach.
Molecular studies to detect genes in weaker salmonella strains.

Results

AU has designed a series of food safety programs aiming at educating and training of FDA food inspectors, food processors, and managers of the food industries.

A study was conducted to determine if bacteriophages that prey on the bacterial pathogen Salmonella could be used to control salmonellosis in cattle, a significant problem in both dairy and beef herds. This work is important because bovine products such as milk and beef become contaminated with Salmonella, and people who consume these products can become ill. In addition, many strains of Salmonella are resistant to multiple antibiotics, which causes treatment failure in sick animals and humans. When bacteriophages were used to treat infected dairy calves, their disease signs disappeared, and they shed much fewer of the Salmonella into the environment. These findings indicate that bacteriophages might be used in place of antibiotics to treat cattle with salmonellosis, and thus decrease the incidence of salmonellosis in humans.

Yghc gene detected in weaker strains of salmonella that could be used as possible candidates for vaccine development.

4. Associated Knowledge Areas

KA Code	Knowledge Area
304	Animal Genome
503	Quality Maintenance in Storing and Marketing Food Products
504	Home and Commercial Food Service
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

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	Actual
2012	20

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Workforce need to be trained in the area of food processing, food safety, and food security

What has been done

The food science program was added now in the Department of Poultry Science. Students are coming in and they are in degree programs.

Results

Students are trained, and they are ready to get into the food industries.

4. Associated Knowledge Areas

KA Code	Knowledge Area
304	Animal Genome
307	Animal Management Systems
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
501	New and Improved Food Processing Technologies
503	Quality Maintenance in Storing and Marketing Food Products
504	Home and Commercial Food Service
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

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 major issue in research is the lack of research funding.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Food safety is a priority program at Auburn University. Starting with AU Food Safety Initiative three years ago, Auburn has developed this initiative into a broader initiative of AU Food Systems Initiative. Under this initiative, researchers are working on research, training, and extension. Good results have been achieved in the initial phase of this program. Dr. Pat Curtis was appointed as the first Director for the AU Food Systems Initiative, with the intention to further develop this program with the goal for the establishment of a Food Systems Institute at Auburn. This last year, this initiative was formally recognized as an Institute, the Food Systems Institute.

At Tuskegee University, food safety is central and very critical as we develop and build the new Food processing facility for limited resource producers

Key Items of Evaluation

Auburn University Food Systems Institute was established in 2012 with the focus of food safety research, training, technology development and outreach. This Institute has made major progress with its obtaining of \$6.5 million grant from FDA. Very recently, NIFA made an Award of \$4.8 million to a group of scientists including TU led by Dr. Christy Bratcher.

Various virtual training modules are being developed with the goal of becoming a training hub in southern US for food safety.

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Childhood Obesity

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
701	Nutrient Composition of Food			10%	10%
702	Requirements and Function of Nutrients and Other Food Components			5%	5%
703	Nutrition Education and Behavior			10%	10%
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources			5%	5%
724	Healthy Lifestyle			25%	25%
802	Human Development and Family Well-Being			10%	10%
805	Community Institutions, Health, and Social Services			5%	5%
806	Youth Development			25%	25%
903	Communication, Education, and Information Delivery			5%	5%
	Total			100%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	10.0	10.0
Actual Paid Professional	0.0	0.0	14.0	10.0
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	784000	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	784000	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	232075
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	377013
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	679973
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	651824
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

This program was named Childhood obesity, but the program was expanded to include all human health-related issues.

Research was conducted to study of molecular and cellular mechanisms of obesity, mapping of obesity-related traits in the genomes using animal models, surveys on lifestyle habits (food choice, exercise) of citizens, evaluation of underlying reasons for these habits, program development for improvement, and measuring adoption of improved diets and activity levels. Research will also be conducted on, for example, animal production such that meat products are healthier. In addition, research activities explored non-traditional means of delivery of nutritive components. Research results were 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.

Specifically some highlights of activities included using avatars as a part of a multi-faceted intervention program to prevent childhood obesity in Alabama; studies for linkages between identity development and romantic relationship beliefs and experiences in a sample of rural and urban African-American and white communities; studies to demonstrate sleep as a support for social, emotional, and cognitive development in children; and a number of studies of food additives, functional foods in prevention of diabetes and obesity.

Studies were conducted to assess the Influence of forest cover on incidence of West Nile Virus. A project in the School of Forestry and Wildlife Sciences, led by Dr. Graeme Lockaby, is focused on the relationships among forest cover, climate variability, and mosquito vectored diseases such as West Nile Virus (WNV). The USDA funded project includes collaboration with the US Forest Service and the Epidemiology Department at the University of Alabama at Birmingham. Mosquito vectored diseases such as WNV, malaria, dengue, and yellow fever are responsible for killing the most people in history. West Nile virus, the most important mosquito transmitted pathogen in the US, has infected cc. 3 million people and sickened at least 780,000 in the US since its arrival in 1999 and, in 2012, reached very high incidence rates in the southeastern US. Mosquitoes depend very heavily on their environment for their survival and reproduction and, in the Southeast, much of that environment is influenced by the presence or absence of tree cover. Mosquitoes lay their eggs on or near natural water bodies and artificial containers, in which their larvae develop. This association with water explains the importance of precipitation and temperature for these insects, factors which vary widely between forested vs. non-forested cover. Also, water pollution and unstable hydrology, two factors which are associated with loss of forest cover and increases in impervious surfaces, contribute to larval success. In this project, the hypothesis that hydrologic changes and reduced water quality lead to increased mosquito populations, and therefore an increased risk of transmission of WNV is being tested. A combination of field and laboratory studies were used to uncover the mechanisms that cause incidence to increase as urbanization takes place. Both environmental (e.g. forest structure) and socio-economic (e.g. income) factors were analyzed in unison. Preliminary results suggest that mosquitoes can reproduce in water quality levels associated with land use conversion from forest to urban and that transmission risk increases with increasing impervious cover and decreases as incomes rise.

Research was conducted to determine the relationship of snacking and overall diet quality among adults. It was found that snacking was not associated with poorer overall diet quality, but was associated with a slightly more nutrient-dense diet. Total fruit, whole fruit, whole grains, milk, oils, and sodium component scores were positively associated with snacking frequency. This study is the first to show that snacking is positively associated with overall diet quality. Contrary to expectation, snacking was associated with a slightly more nutrient- dense diet. Much of the literature on snacking has focused on the contribution it may have on single nutrient intakes; however, this focus may overlook the total nutritional impact of snacking.

Research was conducted to assess impact of emotional health on development of infants and toddlers when they are in full day, non-parental childcare settings. Longitudinal results indicate that negative emotions are experienced more frequently, at greater intensity, and for a longer period of time

than is generally suggested from past theory/research. The findings have implications for child-care providers, teachers, and parents.

Research was conducted to determine Biopsychosocial Factors in Economically Disadvantaged Preschool Children's Adjustment. Responses to stress were measured with physical responses, including changes in heart rate, vagal tone (which reflects a person's ability to physiologically calm himself or herself), speed of heart contractions (which reflects the intensity of the fight or flight response), and stress-hormone levels. Associations were made between children's responses to stressful situations and to interactions with their parents. Evidence for cross-generational continuity in risk is being accrued.

Research was conducted to study peer stress in preadolescence: psychophysiological and coping responses. Longitudinal research found that some children show suggested maladaptive patterns of over-responsiveness to peer stress. In particular, socially anxious preadolescents who experienced elevated levels of peer victimization were particularly susceptible to physiological indices of emotional arousal (e.g., higher heart rate, lower respiratory sinus arrhythmia) in the context of common peer stress experiences, as well as higher aggressive and lower pre-social behavior. Other analyses have suggested maladaptive patterns of under-responsiveness to peer stress. For example, associations between peer victimization and aggressive behavior were stronger among preadolescents who exhibited lower levels of electrodermal reactivity to peer stress, compared to preadolescents who exhibited higher levels of electrodermal reactivity. In addition, preadolescents who exhibited lower levels of respiratory sinus arrhythmia reactivity and reported higher levels of disengaged coping were rated by teachers as particularly low in social competence, compared to preadolescents with more engaged physiological or coping responses.

Studies were carried out using avatars to assist children in determining healthy weight and size. Eighty six percent of the students reported that seeing the avatar change in size helped them think about maintaining a healthy weight. Seventy-six percent of the students reported that seeing the avatars could help them think about their own best, healthy body size. Children in the intervention group showed an increase in their overall knowledge, attitudes, and beliefs about nutrition over time compared to the other children. The intervention group substantially improved on their overall knowledge after involvement in the intervention, and improved their intentions to choose healthier. Intervention children also showed improvement in choosing the correct responses about which food items had more fat when compared to the other children. Finally, the intervention group increased their general nutrition knowledge regarding fat, sugar, food labels, and smart food decisions.

Dr. Mathews' research showed that serum phosphorylated fetuin A concentrations were significantly elevated in diet-induced obese mice compared to their lean counterparts, and showed a positive correlation with insulin resistance. In response to an oral glucose challenge, plasma concentrations of phosphorylated fetuin-A levels demonstrated a temporal increase in mice fed regular chow. However, in the diet-induced obese mode, plasma phosphorylated fetuin-A levels showed a significant temporal decrease. These findings suggest that phosphofetuin-A may be dynamically involved in the insulin response.

Dr. White's work found that hepatic glucose production from lactate is inhibited in diabetic rats chronically treated with leptin in an isolated perfused liver system, as well as in primary hepatocytes cultured from livers of leptin-treated diabetic rats. In addition, a large dose of IP glucagon did not increase the absolute blood glucose concentrations of leptin-treated diabetic rats to levels observed in vehicle-treated diabetic rats. Therefore, it appears that leptin-treated diabetic rats are resistant to the effects of glucagon, which may help explain why leptin treatment of diabetic rats normalizes blood glucose concentrations to that of nondiabetic rats. Glucagon did not increase or maintain blood glucose concentrations in leptin-treated diabetic rats as it did in vehicle-treated diabetic or nondiabetic rats. Leptin treatment appears to decrease the responsiveness to glucagon, contributing to the normalized blood glucose concentrations of leptin-treated diabetic rats.

Research conducted by Dr. Huggins has shown that SDA inhibits adipocyte differentiation by decreasing expression of adipogenic transcription factors and adipogenic lipid-accumulation genes in a dose-dependent manner in 3T3-L1 cells. SDA also inhibited triglyceride accumulation in a dose-dependent manner. Similar effects were seen with the omega-3 fatty acids DHA and EPA. The omega-3 fatty acid, ALA, did not inhibit adipocyte differentiation of 3T3-L1 cells to the same extent as SDA. Dr. Huggins work

has shown that SDA inhibits LPS-induced inflammation to a similar extent as fish-oil omega-3 fatty acids (DHA and EPA). SDA decreased gene expression of tumor necrosis factor-alpha and interleukin-6.

Dr. Jeganathan's work has addressed 1) the interaction of p62 with IRS-1 on insulin stimulation, 2) mapped the interaction domain of p62 with IRS-1, 3) analyzed the involvement of p62 in insulin signaling. His studies demonstrate that IRS-1 interacts with p62 on insulin stimulation. Mapping studies demonstrated that the SH2 domain at the amino terminus of sequestosome 1 / p62 interacts with IRS-1 upon insulin stimulation. Further, IRS-1 interacts with p62 through its YMXM motifs at Tyr-608, Tyr-628, and/or Tyr-658 in a manner similar to its interaction with p85 of PI-3 kinase. Overexpression of p62 increased phosphorylation of Akt, GLUT4 translocation, and glucose uptake, providing evidence that p62 participates in the insulin-signaling pathway through its interactions with IRS-1.

Dr. Bub's findings speak to the importance of children's physical and emotional well-being for their academic success. In particular, she has documented the effects of sleep problems on children's academic and adjustment outcomes. Her research also is improving understanding of how social skills are related to achievement (and thus address whether a whole child approach to education is more effective than targeted academic reform efforts).

Drs. Kwon's and Chattaraman's findings of the usability testing of the prototype conversational agents show a significant role of the use of conversational agents in enhancing the interactivity and social presence of an Internet interface for older users. Preliminary results demonstrate that for older users, agents that play the role of a doer by performing actions on behalf of the users may more effectively enhance their interactivity with an Internet interface than do agents that play a mere helper or facilitator role. The findings also provide insight into potential effects of the increased interactivity and social presence through the use of agents in eliminating cognitive and socio-psychological barriers older users may face in adopting Internet applications.

At Tuskegee University, research physical activities and healthy food choices is focused on pre K and K students in underserved communities particularly, the Black Belt counties. A Color Me Healthy curriculum is being implemented in the classes to learn about healthy food choices. Fruits and vegetable gardens planted by the students are used to provide practical lessons of healthy food choices.

2. Brief description of the target audience

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

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
Actual	50000	200000	10000	60000

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

Patent Applications Submitted

Year: 2012

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	10	86	96

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- publications

Year	Actual
2012	96

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Optimal nutritional recommendations made available to citizens
2	Public awareness of the relationship of healthy food and wellbeing and obesity
3	Reduction in obesity and overweight rate (66.6% in 2008) in population and children, and reduction of the level of obesity
4	health care cost will be lowered as a result of obesity reduction.

Outcome #1

1. Outcome Measures

Optimal nutritional recommendations made available to citizens

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Public awareness of the relationship of healthy food and wellbeing and obesity

2. Associated Institution Types

- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	100500

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The public need to know the relationship of the food they consume and the obesity

What has been done

A serious of research projects, educational programs and extension programs were developed to provide awareness in an effort to reduce obesity.

Results

Alabama is still one of the most obese states in the country. However, the public awareness has been enhanced. A number of educational and outreach programs targeted to reduce obesity in the state has been extremely successful.

4. Associated Knowledge Areas

KA Code	Knowledge Area
701	Nutrient Composition of Food

703	Nutrition Education and Behavior
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
724	Healthy Lifestyle
802	Human Development and Family Well-Being
805	Community Institutions, Health, and Social Services
806	Youth Development
903	Communication, Education, and Information Delivery

Outcome #3

1. Outcome Measures

Reduction in obesity and overweight rate (66.6% in 2008) in population and children, and reduction of the level of obesity

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

health care cost will be lowered as a result of obesity reduction.

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.)
- Other (catastrophic food poisoning)

Brief Explanation

The economic down turn may have had a negative impact on human health, wellbeing, and happiness, which may have increased the level of obesity.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Research in this area has allowed a better understanding of the factors that influencing human health, wellbeing, and happiness. Other than nutrition, a number of social factors are also very important to child development and their eventual success. In particular, a number of studies have documented the impact of stress, child relationship with day care, sleep and other factors on success of the children.

Seniors are increasingly finding the necessity to engage in Internet technology (e.g., online healthcare management, banking, shopping, and trading). Despite its usefulness, the adoption of the Internet among a large majority of the older population has been limited. Dr. Kwon's AAES research projects have allowed for discovery of the physical, cognitive, and social issues which lead to impediments in technology usability among older users. Further, Dr. Kwon and her collaborators have developed web-based interfaces incorporating innovative intelligent virtual agent technology that significantly reduces older users' physical, cognitive, and social barriers to Internet adoption. This research have significant implications for quality of life among the elderly community by fostering greater independence and empowerment, facilitating social interactions and communications, and bolstering self-efficacy and morale among seniors.

- Associations between individuals' frequency of eating occasions (meals and snacks) and their total energy intake was found. The prevalence of obesity has been found to be especially high among those individuals with low-incomes and subsequently having a low-income is one of the most important determinants of food insecurity (the absence of access at all times to enough food for an active, healthy life).

- Children in full-day preschool/daycare programs are (on average) suffering a sleep deficit during the work week (i.e., when they would be attending the child care program) and this deficit is not made up by daytime naps (El-Sheikh et al., in press). Children's overall sleep organization (e.g., duration, time awake while in bed, number of times waking after initial sleep onset) are significantly correlated (that is, children with less optimal night time sleep tended to have less optimal daytime sleep as well). Importantly, sleep disturbances (either in duration or in overall sleep quality and organization) interfere with children's adaptive functioning in the preschool setting. Children whose sleep quality-sleep

Training sessions for youth on developing competencies in nutrition and healthy leaving showed that majority of the students after the training programs have shown willingness to make positive change in their eating habits and healthy life style.

Organization is disturbed at night were less able to organize story narratives in a coherent and meaningful way than were children whose night time sleep was less disturbed. Children who had less overall night time sleep received lower scores on standard tests of vocabulary knowledge, were less accepted by their peers, understood less about the causes of emotion states in others, and were described by their teachers as less well adjusted in the classroom, in comparison to children who had relatively more night time sleep.

- Children who experience harsh or insensitive care are at greater risk for development of social, psychiatric, and physical health disorders. A key to understanding the long reach of early relationships appears to be activity of the stress-response systems, including the hypothalamic-pituitary-adrenal (HPA) axis and its primary end product in humans, cortisol. Poorer quality care in early childhood leads to dysregulation of the HPA axis, which in turn triggers a wide range of maladaptive processes. This work is likely to have high impact because the most salient sources of stress in the lives of young children are poor quality relationships with care givers. Decades of research document increased risk for children who grow up in persistent poverty or with harsh or insensitive parents, particularly if those adverse circumstances are present very early in the child's life. Only now, however, are researchers beginning to identify the biological processes that link early adversity to life-long health. Research linking parent-child and teacher-child relationships with key components of the

stress response will be key in understanding of biochemistry and social success.

Key Items of Evaluation

- Research at Auburn in this program area has focused on the relationship of a number of factors affecting human health, wellbeing, and obesity. In particular, researchers have focused on eating habits such as individuals' frequency of eating occasions (meals and snacks) and their total energy intake, sleep patterns and health, stress and social development, and the adoption of the Internet communications with the happiness and wellbeing of the elderly. The following are some of the key findings:

- The prevalence of obesity has been found to be especially high among those individuals with low-incomes and subsequently having a low-income is one of the most important determinants of food insecurity (the absence of access at all times to enough food for an active, healthy life).

- Children in full-day preschool/daycare programs are (on average) suffering a sleep deficit during the work week (i.e., when they would be attending the child care program) and this deficit is not made up by daytime naps (El-Sheikh et al., in press). Children's overall sleep organization (e.g., duration, time awake while in bed, number of times waking after initial sleep onset) are significantly correlated (that is, children with less optimal night time sleep tended to have less optimal daytime sleep as well). Importantly, sleep disturbances (either in duration or in overall sleep quality and organization) interfere with children's adaptive functioning in the preschool setting. Children whose sleep quality-sleep organization is disturbed at night were less able to organize story narratives in a coherent and meaningful way than were children whose night time sleep was less disturbed. Children who had less overall night time sleep received lower scores on standard tests of vocabulary knowledge, were less accepted by their peers, understood less about the causes of emotion

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Sustainable Energy

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
102	Soil, Plant, Water, Nutrient Relationships			5%	5%
125	Agroforestry			5%	10%
201	Plant Genome, Genetics, and Genetic Mechanisms			0%	5%
202	Plant Genetic Resources			5%	10%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			5%	5%
205	Plant Management Systems			10%	15%
211	Insects, Mites, and Other Arthropods Affecting Plants			5%	5%
212	Pathogens and Nematodes Affecting Plants			0%	5%
216	Integrated Pest Management Systems			10%	10%
402	Engineering Systems and Equipment			15%	0%
405	Drainage and Irrigation Systems and Facilities			10%	0%
601	Economics of Agricultural Production and Farm Management			5%	10%
603	Market Economics			10%	5%
605	Natural Resource and Environmental Economics			10%	10%
607	Consumer Economics			5%	5%
	Total			100%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	8.0	9.0

2012 Alabama A&M University and Tuskegee University and Auburn University Combined Research Annual Report of Accomplishments and Results

Actual Paid Professional	0.0	0.0	10.0	9.0
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	730380	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	730380	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	92345
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	167698
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	302105
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	289124
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 address issues related to renewable energy using bio-based feedstocks that ultimately contribute to the relief of energy dependence on foreign sources. The goal of this program is to increase our knowledge of bioconversion of feedstocks to bioenergy and bioproducts, bioprocessing systems, biomass production, and conversion of byproducts into value-added products and to enhance understanding of the long-term sustainability of feedstock production and bioconversion systems including economics, social issues, land use policies, and energy security and the environment. Specific areas of research include, but are not limited to: alternative crops for efficient production of bioenergy feedstocks, biotechnology of bioenergy crops to enhance production or to enhance its utilization as an energy source, development of agricultural practices for newly identified bioenergy crops, and technology development for bioenergy conversion. This priority is aligned with new initiatives on Bioenergy and Bioproducts Research in DOE, USDA, and several other federal agencies, and with the huge energy demands in the state and the nation.

2. Brief description of the target audience

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

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
Actual	0	0	0	0

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

Year: 2012
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	25	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Publications

Year	Actual
2012	25

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Development of efficient bioenergy crops
2	Increased acreage of bioenergy crops such as corn, switchgrasses, sweetpotatoes, and canola.
3	Increased percentage of bioenergy in the overall consumption of energy

Outcome #1

1. Outcome Measures

Development of efficient bioenergy crops

2. Associated Institution Types

- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Efficiency of bioenergy crops have to be evaluated

What has been done

Several white flesh sweetpotato germplasm high in dry matter have been evaluated
Studies on bamboos and Miscanthus as potential energy crops have been initiated

Results

Several high dry matter and yielding and sweetpotato germplasm has been selected for their ethanol production potential

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
125	Agroforestry
201	Plant Genome, Genetics, and Genetic Mechanisms
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
216	Integrated Pest Management Systems

402	Engineering Systems and Equipment
405	Drainage and Irrigation Systems and Facilities
601	Economics of Agricultural Production and Farm Management
603	Market Economics
605	Natural Resource and Environmental Economics
607	Consumer Economics

Outcome #2

1. Outcome Measures

Increased acreage of bioenergy crops such as corn, switchgrasses, sweetpotatoes, and canola.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Increased percentage of bioenergy in the overall consumption of energy

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

Brief Explanation

Gas prices, national and global determination, and availability of many other types of energy sources can seriously affect the outcomes.

Continued funding is required to produce meaningful results.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Auburn University is one of the collaborating institutions on a USDA Bioenergy CAP grants. Working through this CAP project consortium, various public-public, and public-private partnerships have been developed including:

The IBSS Partnership - The Southeastern Partnership for Integrated Biomass Supply Systems

(IBSS) will reduce the risks surrounding the sustainable, reliable, and predictable supply of lignocellulosic feedstock needed for commercial biofuels production. The IBSS Partnership, which includes ArborGen, Auburn University, Ceres, North Carolina State University, the University of Georgia, and The University of Tennessee, has three overarching goals are:

- Demonstrate implementable 'real-world' solutions to the economic and environmental barriers that limit sustainable and reliable biofuels production.
- Introduce new tools and metrics for effective decision-making in site selection and regional deployment of biofuels production from lignocellulosic biomass.
- Provide credible, impactful, and integrated education, extension and outreach (E2O) programs that train the workforce needed, and inform stakeholders and policy makers with the knowledge necessary to fully enable the Southeast's biofuels industry.

At the time the IBSS partnership made their initial application to USDA-NIFA, ClearFuels provided a letter of support and became a key technology provider in the program. With the acquisition of ClearFuels by Rentech, and based on additional detailed discussions, The IBSS Partnership and Rentech are moving to strengthen the relationship, tightly integrating the IBSS sustainable biomass production and supply processes with Rentech's biomass gasification and drop-in fuels production processes.

Rentech Inc. - Rentech is a publicly traded company with a market cap in excess of \$400 million. Its core business is focused on providing clean energy solutions. They own and develop technologies that enable the production of liquid fuels and renewable power from biomass. Their clean energy portfolio includes biomass gasification technology that can produce synthesis gas for production of renewable power and fuels. They own the patented Rentech Process that is based on Fischer-Tropsch chemistry capable of producing hydrocarbon mixtures. Standard refining practices are used to upgrade the hydrocarbon to diesel or jet fuels, or industrial chemicals. They are nearing the end of a DOE-funded project to design and build a 20 ton/day biomass gasifier to provide synthesis gas for the process described above.

To demonstrate the synergies created by the combination of these two alternative energy organizations, IBSS has supplied Rentech with almost 120 tons of biomass from 5 well-defined sources. This IBSS-supplied biomass includes: 1) woody biomass harvested with very efficient, low cost operations; 2) woody biomass with known genetic characteristics (pine and hybrid poplar); and, 3) switchgrass produced and harvested with advanced low-cost approaches. Rentech will process the biomass in its gasification and fuel synthesis demonstration plant in Commerce City, CO. The pilot plant processing will allow the IBSS Rentech partnership to determine the impact of different biomass sources on the operation and performance of the Rentech gasifier. Also, preliminary information on syngas composition effects on the Fischer-Tropsch reactor will be generated for these regional feedstocks. More importantly, the work will enable preliminary assessment of economic, environmental, and social sustainability aspects of large-scale biomass production for a commercially viable thermochemical conversion process.

Anticipating a successful demonstration project, the IBSS-Rentech partnership plans to conduct extended campaigns necessary to fully evaluate the sustainable environmental and social impacts of large-scale biomass production in the SE US.

Specific outcomes of the program include:

- Demonstrated performance of IBSS feedstock in the Rentech pilot plant for production of diesel and jet fuels. This could include four 60-day demonstrations on four separate IBSS feedstocks producing approximately 9000 gallons of fuel from each feedstock. (1,200 tons of IBSS feedstocks would be required for each 60-day run).
- The availability of Rentech's drop-in diesel to IBSS feedstock partners for use in their planting, harvesting and chipping operations, as well as jet fuel for certification and demonstration by a major airline and/or a jet engine manufacturer.

- Information for a detailed assessment of the economic, environmental, and social sustainability challenges of large-scale biomass production for specific sites in TN, AL, and NC. These sites will include at least two sites where there is some infrastructure in place, e.g., under capacity wood products or pulp and paper mills; low value, degraded lands that may be suited for low cost biomass production, or other unique attributes.
- The IBSS-Rentech partnership will advance additional education, Extension and outreach efforts in these local communities to assess their viability as a biomass to liquid fuels host site. The first group of SEED Fellows from Auburn and Tuskegee Universities recently spent 10 days at Rentech's BioEnergy Center of Excellence learning about the Rentech processes and experiencing technology development environment, providing a foundation for further work.
- Upon conducting preliminary site evaluations, Rentech will complete scoping studies for 1 to 3 sites including initial economics for a commercial process. This phase will also offer an opportunity for one-to-three graduate students from the IBSS institutions to participate in a Rentech internship.

1. Institutional Uniqueness (Include a description of the unique or novel features of the project, the expertise of the PI(s), and the facilities/equipment available to support the project, all of which should demonstrate that UT is the logical location for this work):

This multi-institutional project involves researchers and outreach specialists from academic, government, and industry organizations across the southeastern United States. It leverages significant prior investment and extensive expertise in the area of alternative liquid fuels from cellulosic biomass. The IBSS Partnership is uniquely qualified to accelerate the deployment of a drop-in fuels industry in the region.

Key Items of Evaluation

The IBSS Partnership is currently operating under a grant funded by USDA's National Institute of Food and Agriculture. The grant was independently peer-reviewed and awarded a total of \$15 million in funding over 5 years; however, the total funding was \$30 million less than requested for the complete project.

Apparently, bioenergy research depends on continued funding. Its long term impact will depend on many factors, in particular the gas prices, and availability and economics of many different types of energy sources such as wind, solar, natural gas, etc.