ANNUAL REPORT OF ACCOMPLISHMENTS

Alabama Agricultural Research Programs (AARP)

at the

Alabama Agricultural Experiment Station
(Auburn University)

and

The Winfred Thomas Agricultural Research Station
(Alabama A&M University)

and

The George Washington Carver Agricultural Experiment Station
(Tuskegee University)

for

Federal Fiscal Year
2004

October 1, 2003 – September 30, 2004

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EXECUTIVE SUMMARY

Alabama is fortunate to have three land-grant universities - Alabama A&M University, Auburn University, and Tuskegee University - with distinct programs at each institution based on clientele needs. As administrators of the Alabama Agricultural Research Program (AARP), we are working cooperatively to enhance partnerships among our universities in all areas of research, education, and extension; with other universities in the region, nationally, and internationally; and with state and federal laboratories and agencies. Alabama's three land-grant universities have played key roles in the development of agricultural enterprises in Alabama. The agricultural research programs of these universities have formed a partnership, via a memorandum of understanding, known as the Alabama Agricultural Land-Grant Alliance (AALGA) to better address critical issues in food, agriculture, and natural resources in the state, region, and nation through multidisciplinary, multi-institutional, science-based teams that focus on the opportunities and the challenges facing farmers, consumers and agribusinesses. AALGA also seeks to provide quality education that prepares professionals for career opportunities in food, agriculture, and natural resources. AALGA received state funding in support of this partnership in FY 2002, 2003 and 2004.

In recognition of the importance of international agriculture programs in promoting the competitiveness of U.S. agriculture in the global market place, Alabama's agricultural research programs support and participate in the efforts of international program offices at the three institutions.

This Annual Report of Accomplishments and Results is a reflection of research activities for the 2004 fiscal year as reported in the Plan of Work required by the Agricultural Research, Extension and Education Reform Act (AREERA) of 1998.

Five state programs are reported in the Five-Year Plan of Work under the various REE goals. These state programs are:

State Program 1:	Attain Globally Competitive Alabama Agricultural and Forestry Production Systems
State Program 2:	Enhance Food Safety, Quality and Processing Technologies
State Program 3:	Improve Human Nutrition and Health
State Program 4:	Develop and Enhance Sustainable Ecosystems to Protect Natural Resources and Bio-diversity
State Program 5:	Ensure Socioeconomic and Self-Empowerment of Families and Communities

Several multi-disciplinary research projects are grouped under the Key Program Components associated with each state program.

ANNUAL REPORT OF ACCOMPLISHMENTS AND RESULTS FOR AGRICULTURAL RESEARCH PROGRAMS IN THE STATE OF ALABAMA

POINTS of CONTACT: This plan is jointly submitted by: *Dr. Michael J. Weiss* (Auburn University), *Dr. Walter Hill* (Tuskegee University) and *Dr. McArthur Floyd* (Alabama A&M University). Although questions and other comments regarding the document can be directed to any of us, technical concerns should be addressed to Michael J. Weiss, who is providing leadership in this effort.

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Adoptions by Reference:

- Alabama Agricultural Research Plan for the 21st Century
- Programs School of Agricultural and Environmental Sciences
- Handbook for Research Project Leaders for the Alabama Agricultural Experiment Station
- Administrative Manual for Evans-Allen Cooperative Agricultural Research-Project Approval
- Globalizing Agricultural Science and Education Programs for America (GASEPA)

ANNUAL REPORT OF ACCOMPLISHMENTS AND RESULTS

I. PLANNED PROGRAMS

Following is the Annual Report of Accomplishment and Results for FY 2004 for the Alabama Five-Year Plan of Work which is based on the five national goals within the Research, Education and Economics (REE) Mission Area of USDA:

Goal 1: An Agricultural System that is Highly Competitive in the Global Economy

State Program 1: ***Attain Globally Competitive Alabama Agricultural and Forestry Production Systems***

Overview

Effective functioning of America's agricultural system in a highly competitive global economy is a major contributor to the national economic growth and well-being of the American people. The ability of Alabama farmers and agriculturally-based products to successfully compete in today's aggressive national and global markets depends on careful market analysis, research on new alternative and innovative products, and dissemination of information on new production methods based on sound scientific data to farmers. The land-grant universities in Alabama have initiated research programs to keep the agricultural industry in Alabama competitive.

For example, scientists at Tuskegee University have continued to focus their research on functional and new alternative food products, plant and animal genomics, food production efficiency, biotechnology, and small farm viability. The programs have resulted in the development of new sweetpotato- and peanut-based products, improved profitability of small farms, alternative animal feed from agricultural by-products, new sweetpotato varieties, gene maps of chickens and other poultry species, development of transgenic sweetpotato plants with a high protein content, and biosafety tests for transgenic products.

At Auburn University, scientists have been involved in various areas of plant and animal research that contribute to increasing the economic status of producers. These programs have resulted in new and improved cropping methodology in agronomic and horticultural crops, including identification of "low input" pecan cultivars and evaluations of peanut management practices that can reduce production costs, particularly with newer cultivars. Animal science research has led to means by which to reduce disease problems in poultry and parasite problems in goats.

Research efforts at Alabama A&M University have focused on the economics and social well-being of families and farmers, improved crop production via enhanced agronomic performance and manipulation of genetic structures, agroforestry, natural resource management, and the development of alternative specialty crops.

The three universities have placed high emphasis on providing experiential learning and graduate education opportunities for undergraduate and graduate students enrolled in various academic programs associated with the research described above and throughout each goal.

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Allocated Resources ($) and Scientists Years (SY) for State Program 1

Inst.	FY 2000		FY 2001		FY 2002		FY 2003		FY 2004	
	Approximate Expenditures ($)	SY	Approximate Expenditures ($)	SY	Approximate Expenditures	SY	Approximate Expenditures ($)	SY	Approximate Expenditures ($)	SY
1862 (AL)	15,411,148	56	13,957,013	42	14,654,863	42	15,378,606	42	15,378,606	42
1890 (ALAX)	1,247,000	7	1,408,995	8	1,479,444	8	1,553,416	8	1,631,086	8
1890 (ALX)	775,250	6	820,938	6	861,984	6	793,524	6	809,394	6
Totals	17,433,398	69	14,918846	56	16,220,501	56	17,837,105	56	17,819,086	56

Key Theme: Value-added Foods:

Statement: At Tuskegee University, studies continue with the development of novel functional foods using food crops such as purslane, sweet potato greens, and muscadine grapes. These crops were evaluated for their phytosterol and antioxidant phytochemical content and as functional food sources. Phytochemicals in these foods are known to reduce blood cholesterol levels and decrease overall heart disease risk. Several isoflavones were identified in the purslane and sweet potato greens. Several sensory research analyses have shown that these novel vegetables are generally accepted in the diet. Incorporation of such novel functional foods in diets of at-risk communities will assist in the reduction of heart disease and the risk of atherosclerosis, and increase the nutritional well-being of the targeted underserved communities.

Statement: The poultry and livestock industry must continue to serve as sources of high quality protein in Alabama, the U.S. and the world. Consumer preference for certain muscles from meat animals continues to remain high. Traditional attempts to improve muscle yield focuses on genetic selection and optimum nutrition and management.

Key Theme: Economics

Statement: Auburn University researchers are evaluating alternatives to propane for heating poultry houses, including more integrated fuel, air and ventilation management, along with insulation. These alternatives are yielding improvements in flock performance, in air and litter quality, and reduced heating/brooding expense to growers.

Key Theme: Improved Crop Systems

Statement: With increased awareness of health foods, sweet potato continues to attract attention as an important source of food and food products with health benefits. It is also an efficient producer of dry matter and beta carotene for industrial use. Using state-of-the-art technology and rapid assessment techniques, Tuskegee University scientists have developed these traits in breeding populations. These techniques have resulted in the selection of several high yielding sweet potato cultivars with improved versatility and productivity **a**nd are being tested in farmers' fields and other production systems for adoption. These cultivars have consistently produced higher yields than the traditional cultivars currently being grown in Alabama. These cultivars are also suitable for both American as well as specialty Asian, African and the Caribbean markets. Adoption of these cultivars will increase market opportunities for sweet potato farmers in Alabama. A new cultivar is being released for specialty production in hydroponic production systems**.**

Statement: The peanut is an economically important crop in the state of Alabama and Southeastern United States. Tuskegee University is employing biotechnology, including genetic engineering and tissue culture, to map and clone disease resistant loci in the peanut. A genetic map of cultivated peanut has been constructed using AFLP and SSR markers with 126 markers mapped covering 17 linkage groups. A comparative map between peanut and soybean is also in progress to better characterize resistance genes in peanuts that are difficult to work on at the molecular level. Significant progress made in genome of soybean map is anticipated to leverage the molecular advances in peanut that will allow the prediction and ultimately test the roles of resistance genes for peanut improvement. Three hundred and seventy three peanut microsatellite sequences have been submitted to the GenBank. Genomic maps are useful in phylogenetic studies, taxonomic identification, germplasm utilization and breeding programs. Identification of genetic markers linked to resistance genes will be very useful in marker-assisted selection and map-based clones.

Statement: Tuskegee University scientists are using genetic engineering to improve the nutritional content and the quality of the sweetpotato, an important crop in Alabama. Artificial storage protein genes have been successfully incorporated in several sweetpotato cultivars. This has resulted in the development of high protein sweetpotato transgenic lines. Transgenic plants had normal growth and did not show any yield reduction in several greenhouse tests. Biosafety and field tests are in progress.

Statement: Auburn University researchers are studying nursery crop production practices that can minimize winter injury and subsequent plant death, and increase plant growth. Several plant species, that are popular in urbanized locales, are being studied, including butterfly bush, crape myrtle, hosta, and evergreen azaleas.

Statement: The demand for high strength fiber in raw cotton has increased. Improvement of cotton fiber quality through conventional breeding is limited because of the complexity of fiber quality genetics. Scientists at Alabama A&M University have identified and characterized genes related to cotton fiber quality through biotechnology. These fiber-associated gene expressions in *Gossypium barbadense* are leading to better understanding the mechanism of fiber development in cotton and are being pursued diligently by these researchers.

Statement: Genetic engineering offers hope for reniform nematode activity in cultivated cotton. The most consistent and economical means for evaluating reniform resistance without resorting to field tests are root cultures. Alabama A&M University scientists are using technology to amplify single nematode DNA using gel-based markers in a root culture system for several cotton cultigens. Liquid cultures with no hormones provided the greatest root growth based on length. DNA forms positively identified reniform nematodes using ITS1 and 18S ribosomal primers and bands.

Statement: Improved soybean cultivars will help Alabama soybean growers be more efficient in production and stay competitive in the world market. In particular, breeder seed of a new Roundup-Ready soybean line was produced in 2003 and clearance for further development of this line is being sought from Monsanto. A second year of tests on the performance of experimental lines with the “long-juvenile” (lack of photoperiod response) trait has also been completed.

Key Theme: Improved Poultry Systems

Statement: Improved control of economically important diseases of commercial poultry will lead to lower production costs, which will ultimately lead to lower costs for consumers of poultry products at the supermarket. One area of research is looking into management methods to reduce the frequency of bruising and skin diseases in poultry flocks. Optimal conditions relative to crating density and means of transport are being evaluated for minimizing problems by researchers at Auburn University.

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Statement: Tuskegee University scientists are involved in decoding the turkey genome for genes that are implicated in cardiomyopathy with the ultimate goal of developing a genetic model for human heart disease in African Americans. An apolipoprotein (apo) A gene as well as a cycloxygenase (cox) gene have been successfully isolated from the turkey cardiopathic heart. These genes are associated with cholesterol transport and inflammation respectively. Studies are in progress to isolate and analyze the h-C-reactive protein gene, since the protein produced in blood serum is currently a marker for a preemptive heart attack. Also studies are in progress to isolate the the apo B (associated with LDL), and the cox 2 genes from the cardiomyopathic turkeys.

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Key Theme: Improved Animal Systems

Statement: Auburn University researchers are evaluating the effects of feeding goats with sericea lespedeza, a forage crop with condensed tannin content. The tannins in the forage act as anthelmintics in reducing nematode parasitism, a common problem in goat production in the southeastern U.S. Decreased costs associated with worm control can be possible when these forages are fed to the animals.

Statement: Scientists at Tuskegee University continue their research on developing resource management for a sustainable small ruminant industry in Alabama. Studies continue to focus on the determination and use of alternate feed and forages including mimosa (*Albizia julibrissin*), annual ryegrass, eastern gamagrass, Bermuda grass, Sudan grass and perennial peanut to provide year round grazing and browsing for the animals. These studies have resulted in increased weight gain and improved carcass quality of the animals. Studies have also showed that browsing tends to reduce parasite load and can decrease use of anthelmintics when compared to grazing on conventional forages. Good resource management that incorporates alternative feeds such as plant byproducts and feed additives and supplements provides a beneficial effect on diet digestibility and animal performance which can be transferred into lower inputs for better animal output and more profitable production systems.

Key Theme: Development of Alternative Specialty Crops

Statement: Researchers at Alabama A&M University continued the evaluation of the canola genotypes and plant introductions to develop new winter-type canola lines for the mid-south region. Lines selected for winter hardiness, early flowering, plant type, plant height and early maturity as well as the level of damage to plants by aphids and the cabbage seed pod weevil (CSPW) were taken to University of Georgia, Griffin to be included in the black leg disease (*Leptosphaeria maculans*) nursery for disease resistance observation.

Statement: Auburn University researchers continue to evaluate satsumas for production along the Gulf Coast. Because freeze damage has contributed to limited adaptability of this crop, efforts

are underway to identify genes involved in cold acclimation of these and related plants. Additional research has involved the determination of the vitamin C content of the Satsuma mandarin, and an evaluation of consumer preferences on fruit appearance.

Key Theme: Fisheries and Aquaculture

Statement: Auburn University researchers have been evaluating various strains of channel catfish in order to determine if strains differ in growth efficiency in the Southeast U.S. While differences were found among the strains evaluated (HS-5, USDA 103, D&B blue, and USDA 103 x D&B hybrid), the differences might be explained by confounding factors. In addition, studies have looked at the possibility of replacing fish meal with poultry by-product meal for channel catfish rearing. Fish meal was shown to be superior for optimal yield, even though it is more expensive than the poultry-based meal.

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Key Theme: Water Quality

Statement: Tuskegee scientists are evaluating the effect of cropping practices on water quality in the lower Tallapoosa River basin by determining nitrate and phosphorus loading levels on four creeks in the Lower Tallapoosa basin and to test whether PLOAD can be used to accurately predict these loading levels. The water quality of Alabama streams and rivers is very important to the well-being of the citizens of the state. The effect of land use and cropping practices on water quality is important in determining whether to place streams and rivers on the impaired list. Currently, little data are available for determining whether streams and rivers in Alabama are impaired or not. Understanding the water quality of streams and the effect of land use on the quality of the water is important to adopting management systems which result in efficient food production while protecting water quality. Nitrate levels among the creeks or between the seasons were not significantly different. However total phosphorus and orthophosphate levels between seasons were significantly different. These studies will also help to develop agricultural management systems that will help protect water quality while maintaining efficient production. Tuskegee University scientists continue to provide water quality tests of well water samples for Alabama citizens. Long term studies with well water showed that well depth was inversely correlated with nitrate detection.

Statement: Researchers at Alabama A&M University monitored eighteen different streams at a total of 54 locations throughout the Wheeler Lake Basin to evaluate the effects of individual seasonal trends in nutrient concentrations. Although seasonal variations did occur, these variations reflected differences associated with rural and urban activity and not land use types. The highest concentration of nutrients was detected in the summer season. Counties and streams in northern Alabama were ranked based on the nutrient concentration levels.

Key Theme: Economics and Social Well-Being of All Families and Farmers

Statement: Alabama A&M University scientists, in collaboration with Tuskegee University and six other Historic Black (1890) Land-grant Universities, are addressing the educational deficit of agricultural biotechnology in underserved communities of the south. Educational outreach biotechnology teacher training workshops impacting 43 teachers from five different states have been conducted. Also, 92 on-farm demonstrations using biotech crops or products (with controls) such as *Bt* sweet corn, virus-resistant yellow straight neck and zucchini squash, Messenger-

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treated sweet pepper and Roundup-Ready soybean have been evaluated for limited resource farmers. More than 1,000 individuals, including extension agents, small farmers/producers and high school teachers, have benefited by becoming associated with this biotechnology.

Statement: Research at Auburn University contributes to American market competitiveness by gaining a better understanding of consumers' product choices in home décor and clothing styles. Another study is evaluating the choices consumers make when shopping via the internet, and includes an assessment of perceived risks of internet shopping.

Key Theme: Recruitment and Education of Individuals for Career Professions in the Food and Agricultural Sciences

Statement: Scientists at Tuskegee University continue to provide mentorship to high school students through the Summer Apprenticeship Program. This program allows rising high school seniors and juniors to work alongside the scientists in their laboratories during the summer to expose the students to scientific research. This has resulted in increased high school student interest in the sciences and subsequent enrollment in these disciplines in college.

Key Theme: International Collaborations

Statement: Tuskegee University continues to provide technical assistance to targeted communities in several African and Caribbean countries to assist them in their efforts to increase agricultural production and improve the quality of life of the rural poor in these countries. Collaborative programs with the Sokoine University of Agriculture in Tanzania have resulted in the development of sustainable agricultural and aquacultural practices through sustainable natural resource management and enhanced micro enterprise development in four regions in Tanzania. These programs have resulted in an increase in farm family income of targeted villages and communities and use of preservation practices of natural resources. In Ghana, a nutritional enhancement program was developed and targeted at farm families in the Volta region through the use of sweetpotato green leaves and other green leafy vegetables. This program that improves the nutrition of the families, particularly women and children, was successfully adopted by both targeted groups as well as other communities and villages. The program is being duplicated in the Northern Region of Ghana. Collaborative Farmer-to Farmer and Volunteer Technical Assistance Program with Winrock International provided volunteer technical assistance to several farmers, producers, processors and small and medium size agribusiness organizations in Ghana and Nigeria. In Ghana, the program trained over 200 hotel management and food management staff in principles of food safety and food service business development and management, as well as customer service in efforts to enhance the tourism industry in the country. Tuskegee University is also involved in the training and building capacity of 16 African countries in sanitary and phyto sanitary procedures in risk assessment in efforts to increase these countries' ability to export food products to the US. Over 100 scientists from these countries have been trained in risk assessment. Tuskegee University is also involved in training scientists in several African countries in effective communication of biotechnology issues and awareness to policymakers and the public. Regional training workshops are being conducted in Africa.

Goal 2: A Safe and Secure Food and Fiber System

State Program 2: Enhance Food Safety, Quality and Processing Techniques

Overview:

The safety of the food supply is a major concern to policymakers, consumers, distributors, processors, producers, and suppliers. All of Alabama's land-grant universities are striving to meet those demands and to address current and emerging food safety, food quality, nutrition, and health issues, particularly as they relate to consumers, society, industry, and regulatory concerns.

Scientists at Auburn University have initiated research to reduce and prevent food-borne illnesses, such as those caused by Salmonella in poultry. They are also conducting research to identify and map proteins linked to biological processes, such as diet and adaptation, and to delineate genomic and proteomic mechanisms of metabolic fat control in pigs.

Scientists at Tuskegee University have continued to focus on research programs that are aimed at developing methods to reduce pesticide usage and to prolong storage of fruits and vegetables. Other researchers are using natural anti-microbial agents to control food borne pathogens in meat and egg products.

Researchers at Alabama A&M University are focused on finding solutions to the problem of allergenicity of peanuts and to improving the texture, tenderness, shelf-life, and taste of poultry meat.

The success of the research efforts in this area will result in a safer fresh food supply, and an understanding of the effects of genetics, environmental stress, and pathogenic factors on proteins. We will also have a better understanding of food animals and their fattening process. Also, outcomes of the metabolic fat control study are relevant to human dietary concerns. Additionally, final results will provide non-chemical food preservation procedures for a safer food supply.

Allocated Resources ($) and Scientists Years (SY) for State Program 2

Inst.	FY 2000		FY 2001		FY 2002		FY 2003		FY 2004	
	Approximate Expenditures	SY	Approx Expenditures	SY	Approx. Expenditures	SY	Approx. Expenditures	SY	Approximate Expenditures	SY
1862 (AL)	4,837,516	23	3,928,689	13	4,112,123	13	4,331,380	13	4,331,380	13
1890 (ALAX)	196,200	1	116,865	1	122,708	1	128,843	1	130,285	1
1890 (ALX)	219,793	2	239,971	3	251,969	3	**275,359**	**3**	**283,619**	**3**
Totals	5,253,509	26	4,285,525	17	4,486,800	17	4,724,790	17	4,745,284	17

Key Theme: Food Safety – Animal Products

Statement: Alabama A&M University scientists are developing strategies to increase the efficiency of encapsulated butylated hydroxyanisole (BHA) activity in comminuted meats. Extending the shelf-life of ground meat increases the profit margin of producers without increasing the unit price to consumers. The rancidity of treated meat has been greatly reduced; however, the efficiency of encapsulation was not optimized in most recent evaluations. The commercialization of encapsulated antioxidants will add a new dimension to the processing of poultry meat when completed.

Statement: Molecular fingerprinting of bacterial contaminants can provide clues to the origins of the contaminant. Researchers at Auburn University are doing this with salmonella in the poultry industry. By being able to track the origin of these bacteria, more efficient management and clean-up of bacterial contamination is possible.

Key Theme: Food Safety – Fruits and Vegetables

Statement: Sweetpotatoes and tomatoes are economically important crops in the state of Alabama and the southeastern United States. In an effort to improve the sustainability, production and health of these crops, researchers at Tuskegee University are using biological methods to control post-harvest diseases of these crops. The research is focused on using microbial antagonists such as *Rhodotorula minuta* as well as the use of low dose Ultraviolet light-C to prevent post harvest decay of tomatoes and sweetpotatoes. This is important because this can reduce the chemical application to prolong shelf-life and reduce post-harvest losses.

Statement: Insecticide contaminant residues on foods, particularly, fresh fruits and vegetables pose serious food safety problems especially in children. Tuskegee University scientists are working with selected limited resource fresh vegetable producers to reduce the number of pesticide applications to protect their crops from pests. Working with southernpea fresh market growers, and based on demonstrations and monitored application recommendations from the scientists, farmers were able to reduce the number of pesticide sprays by 95%. Growers would normally spray their fields 2-3 times a week. The reduced use of pesticides on food crops particularly on fresh fruits and vegetables improves the safety of the crops and safeguards the health of consumers.

Statement: The combination of ultrasonication and chlorine dioxide solution on fruits and vegetables is a novel system that can be implemented in food industries for increasing food safety. The effects of this treatment are being investigated by Auburn University researchers for reduction of *E. coli* and salmonella bacteria in applies. Evaluations are continuing on the concentrations of chlorine dioxide and treatment times that provide optimal effectiveness.

Key Theme: Genetic and Biochemical Modification of Foods

Statement: Wholesome and safe muscle foods are an excellent, highly available source of critical nutrients, including essential amino acids and B complex vitamins and folic acid among others, for humankind. A negative aspect to muscle foods is that these food products may contain too much fat. Auburn University researchers are looking at the fundamental molecular factors that regulate total fat synthesis as well as the partition of fat deposition among tissues. This work represents a start in delineating regulatory pathways of overall lipid metabolism in pigs. In the

future, this information will enable us to develop specific strategies to not only lower overall carcass fattening, but also to enhance the potential for intramuscular fat (marbling) deposition. Taken together this will enhance overall efficiency of pork production and improve consumer acceptance and sensory characteristics of muscle foods from pigs.

Key Theme - Food Safety and Risk Analysis

Statement: Food availability can depend on the strength of the U.S. grower/producer, and agricultural strength is impacted by governmental subsidies. Work at Auburn University indicates that increasing the subsidy when the US dollar is strong in international markets, and decreasing it when the dollar is weak, could help smooth trade flows and improve efficiency. Varying subsidies with this model can assure a more consistent food supply.

Goal 3: A Healthy, Well-Nourished Population

State Program 3: Improve Human Nutrition and Health

Overview

The socioeconomic status of some Alabama residents restricts their ability to practice healthy dietary habits, including choosing healthy foods and handling food safely. The nutritional quality of diets can assist in the prevention of serious health problems. Our research efforts aim at protecting and enhancing the health of Alabama citizens. Through understanding both societal issues affecting consumers' overall diet-related health and the relationship between diet and specific body function, better quality diets, including increased utilization of food crops and the development of dietary guidelines based on ethnicity, age, and consumption preferences, can be developed.

At Alabama A&M University, scientists are studying the nutrient composition of the shiitake mushroom and its role in nutritional diets. They also are evaluating the diets of the elderly population residing in assisted living long-term care facilities and congregate feeding programs.

At Tuskegee University, scientists have initiated a research program that focuses on improving human nutrition and health of the African-American population in the Black Belt region of Alabama through diet modification and nutrition education.

Scientists at Auburn University are conducting research that evaluates the nutrition composition of foods and how varying foods or supplements can affect human health.

The accomplishments thus far have resulted in development of recipes utilizing novel vegetable sources of high omega-3 fatty acids, i.e., sweet potatoes and purslane. There is also a greater understanding of food quality and product shelf-life of foods. The results are helping the elderly select appropriate foods and portion sizes while preventing the potential of confusing foodstuffs and other substances in the lives of older citizens. The research remains on target with stated objectives.

Allocated Resources ($) and Scientists Years (SY) for State Program 3

Inst.	FY 2000		FY 2001		FY 2002		FY 2003		FY 2004	
	Approximate Expenditures	SY	Approximate Expenditures	SY	Approx. Expenditures	SY	Approx Expendituress	SY	Approx. Expenditures	SY
1862 (AL)	2,227,188	4	1,977,742	10	2,222,355	10	2,333,769	10	2,333,769	10
1890 (ALAX)	134,150	1.2	140,017	1	147,017	1	154,367	1	162,085	1
1890 (ALX)	164,785	1	174,439	2	183,160	2	192,318	2	201,933	2
Totals	2,526,123	6.2	2,292,198	13	2,579,532	13	2,680,454	13	2,697,787	13

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Key Themes: Nutrient Composition of Foods and Nutrition Education

Statement: Non-traditional green leafy vegetables contribute to the larger group of functional foods in the American diet. With proper nutrition education and diet modification, these functional foods can be incorporated in the diets of the African-American population in the Black Belt region where risk of cardiovascular (CVD) diseases are quite high. Tuskegee University scientists have continued to employ clinical as well as food and nutrition education strategies, in efforts to reduce the risk of CVD in these communities. Food and nutrition educational materials that focus on how to lower CVD through proper diets were developed through focus groups and are being distributed in the target communities.

Statement: At Auburn University, food sources are being evaluated for levels of free and bound galactose -- information that may be vital for the treatment of galactosemia. Galactosemia is an inherited disorder of carbohydrate metabolism affecting about 1 in 30,000 to 60,000 infants in the United States. Studies are indicating that galactose, while present in free and bound quantities in meat products specifically processed for baby food, was not present in quantities high enough to warrant limiting the intake these foods in the diets of infants with galactosemia.

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Key Theme - Diet Modification for Targeted Populations

Statement: Consumption of certain fatty acids by infants is important for neural development. Work at Auburn University is progressing on means of assuring that these fatty acids are at adequate levels in the maternal diet. Infants then consume appropriate amounts of the fatty acids through breast-feeding.

Goal 4: Greater Harmony Between Agriculture and Environment

State Program 4: Develop and Enhance Sustainable Ecosystems to Protect Natural Resources and Biodiversity

Overview

Society demands that the quality of our air, water, and soil be protected. Contamination of these resources threatens the continued existence of many plant and animal species. Sustained productivity of Alabama's agricultural, silvicultural, and other natural resource-dependent industries will require immediate and long-term efforts to maintain quality. The agricultural wastes and residues that are generated through animal, poultry, and crop production systems in Alabama can detract from the quality of our resources. In a sustainable agricultural system, these

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residues and wastes could be incorporated into the soil to enhance soil productivity, to improve water infiltration and the plant root environment, and to improve soil quality by improving aggregate formation and stability. Excessive application, however, can result in groundwater contamination with nitrate, phosphates, and trace metals. Chemical composition of organic wastes and plant-residues affect transformation reactions mediated by soil microorganisms. Understanding the controlling factors in relation to microbial population and enzyme activities and mineralization is highly desirable for designing better management strategies.

Research at Tuskegee University is looking at the long-term effects of the application of broiler litter to agricultural lands and its effect on ground water contamination. Studies are also being conducted on soil conservation using grass hedges, on integrated pest management of sweetpotato weevil, and on the use of plasticulture technique in an integrated pest management system.

Scientists at Auburn University are conducting research that focuses on water quality and waste management issues, ozone studies, improved farm management through precision agriculture and remote sensing, and the productivity of soils and the systems that affect them.

Alabama A&M University researchers continue to evaluate the utilization of composted poultry litter on the production of alternative crops such as shiitake mushrooms and in agronomic crops such as cotton to improve productivity and find ways of disposal of poultry waste. Additional research evaluates the mechanism of remediation of heavy metals in soils.

The ultimate goal is to design effective broiler litter management strategies for the different soil types in Alabama. Further, these studies have resulted in new and innovative strategies in waste management, including new approaches to combining poultry waste and cotton gin waste into pellets for field application. In the remote sensing/precision agriculture area, improved management of row crop operations through understanding the sensed data in zones can reduce overall applications of treatments by concentrating on the less productive zones instead of overall field treatments. Understanding the biogeochemistry of soils and their systems has revealed how ecosystems process nutrients and the importance of moisture in wetland productivity as well as the role of soils and its mineralogy to the remediation process.

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Allocated Resources ($) and Scientists Years (SY) for State Program 4

Inst.	FY 2000		FY 2001		FY 2002		FY 2003		FY 2004	
	Approximate Expend.	SY	Approximate Expend.	SY	Approximate Expend.	SY	Approximate Expend.	SY	Approxi. Expend.	SY
1862 (AL)	12,538,179	36	11,825,926	38	12,417,222	38	13,038,083	38	13,038,083	38
1890 (ALAX)	188,200	1.5	92,610	1	97,240	1	102,101	1	107,207	1
1890 (ALX)	324,802	2	268,414	2	281,834	2	215,619	2	222,087	**2**
Totals	13,051,181	39.5	12,186,950	41	12,796,296	41	13,436,109	41	13,367,377	41

Key Theme: Water Quality and Waste Management

Statement: Agricultural lands have been used as an inexpensive location on which to dispose broiler litter in Alabama. Tuskegee University scientists have continued to focus their research on addressing the environmental concerns of ground water pollution and long-term effects on ecosystems of broiler litter applications to agricultural lands. Results of earlier studies indicated that the trace elements on nitrogen transformation varied from soil to soil. Several farms with different soil types in Alabama that have received broiler litter application for over 20 years have

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been sampled and analyzed. Nitrification and enzyme activities were inhibited by the presence of trace elements in the broiler litter. As a consequence of results of this and other research programs, farmers are now more aware of the possible impact of broiler litter on their soils and surface ground quality. More farmers are now reducing or adjusting broiler litter application rates on farmlands throughout the state. This will also assist the state government in developing new tools to monitor and guide organic litter application.

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Statement: Auburn University research is continuing on a number of projects designed to utilize poultry waste and to safeguard water quality through improved land stewardship. One project is looking at the efficacy of alternative litters for poultry houses. Pine shavings litter reaches higher temperatures and composts more fully, and this may allow clean-out in time for pre-plant field application.

Statement: Scientists at Alabama A&M University continue to evaluate the environmental impact of animal waste applied to land, especially that of swine (*Sus scrofa domesticus*) and poultry. The ultimate goal of this research is to define optimal levels of nutrient concentrations, as well as enteric pathogens for safe disposal and the improvement of soil and water quality. Currently, the data suggest that high yielding forage crops remove significant amounts of soil phosphorus from heavy manure applications on land.

Key Theme: Soil Conservation and Soil Quality

Statement: Scientists at Tuskegee University continue to focus on methods of controlling soil erosion to ensure sustainable agricultural production on small limited resource farms. Previous studies have shown that Eastern gamagrass (*Tripsacum dactyloides*) grown as a grass hedge to control erosion can be incorporated in a farming system of a small-scale farm. Current studies are focused on adaptability of several Eastern gamagrass to several acid soil types in the southeastern US and as a phytoremediation agent. Preliminary results indicate that eastern gamagrass performed favorably across the soil types and the pH levels that were studied. The use of Eastern gamagrass for phytoremediation, in addition to its ability to tolerate acid soils, control soil erosion, and its potential as a forage crop can play an important role in a small farm system.

Statement: Often agricultural wastes are burned, and the resultant ash can have substantial impacts on nutrients that are available for use by plants and animals. One project at Auburn University was initiated to evaluate the absorption and desorption of pesticides by ash and ash-amended soils, and to determine how adsorption of pesticides by ashes influences their bioavailability to pesticide-degrading bacteria.

Key Theme: Urban Issues

Statement: The destructive Formosan subterranean termite is moving into new areas of the state, and work at Auburn University is looking at factors influencing this range expansion. The pattern elucidated is that the expansion is along main interstate highways and this indicates that the spread may be aided by human transportation of infested materials such as re-use of railroad ties. Ultimately, awareness of the means of spread can contribute to controlling the spread of this destructive insect pest.

Key Theme: Integrated Pest Management

Statement: Tuskegee University scientists have pioneered soil solarization research in Alabama for the past decade. Soil solarization, the trapping of solar radiation under clear plastic mulch, is used as a biological method to control diseases, weeds and other pests of vegetable crops. Research at Tuskegee University continues to investigate the efficacy of plastic culture in integrated pest management of vegetable crops in Alabama. Several weed species, soil- and foliar-borne diseases can be significantly managed by soil solarization. Soil solarization can have a tremendous impact on the reduction of the use of chemical pesticides in managing weeds and soil-borne diseases.

Statement: Ecological studies of insects interactions on cotton plants are being conducted by Auburn University researchers. Results indicate that higher populations of cotton aphids are associated with higher populations of fire ants. In addition, caterpillar feeding damage of the cotton foliage can be reduced when populations of fire ants are greater. These relationships may indicate that fire ant control in cotton fields should not be implemented.

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Statement: Insect pests continue to be important production constraints on vegetable crops grown by limited resource farmers in many parts of the southern US. Sweet potatoes and southern peas are two vegetable crops that are commonly grown by most limited resource farmers in Alabama. Research at Tuskegee University seeks to improve the production and utilization of these crops by reducing loss caused by the insects and diseases of these crops through an integrated pest management approach. Sweet potato farm surveys are being conducted in Alabama and the southern US to determine the inter-specific variation of the sweet potato weevil. Also, southern peas are also being surveyed for pests and diseases. The information gathered from these studies will be used to design pest management strategies for these crops and to reduce pesticide use. A regional risk assessment of the weevil and a study of pest profiles on sweet potato are in progress. These studies will provide information on the movement of the sweet potato weevil and the potential risks of spread to uninfested areas and how this would impact the management and quarantine regulation of sweet potato movement in the state.

Key Theme: Remote Sensing and Precision Agriculture

Statement: The use of non-destructive technologies (e.g. electrical conductivity mapping) to facilitate detailed mapping (intensive mapping) of soil properties can be beneficial in two ways: 1) the depiction of soil properties is improved so better interpretations and management systems of the soil can be developed, and 2) detailed soil mapping is relatively time-consuming and expensive, so these technologies may improve the efficiency of soil mapping. In particular, the electrical conductivity mapping may hold benefits for both agronomic and urban applications, where soil mapping can range from $5 per acre (agronomic soil mapping), to $500 for an acre parcel (urban applications). Where electrical conductivity mapping is feasible, improved surveys can be developed. Seasonal high water tables can occur in sandy, coastal plain soils above soil features that are considered diagnostic of seasonal high water table depths. These findings can lead to improved assessments of site conditions for OSDS placement in these sandy soils. This can result in substantial savings for a home builder, when one considers the initial costs of OSDS installation range from $2,000 to $5,000, and repairs on malfunctioning systems (due to installation in poor soils) can be costly.

Statement: Auburn University researchers have worked cooperatively with forest industry companies to develop a diameter sensing system for tree-length felling equipment, principally wheeled feller-bunchers. The result of the work will be a method to map yields in timber as is currently done in agricultural field crops. Additional work is being done on relating variability in timber yield maps to site characteristics, principally soil conditions.

Key Theme: Restoration and Best Management Practices (BMP)

Statement: Management practices contribute to the health of and stress on all wildlife populations in our state. Current Auburn University research results indicate the density at which deer populations should be maintained in contained (i.e., fenced-in) areas.

Statement: Wetlands have many beneficial characteristics, such as providing habitat for unique flora and fauna, storing of runoff waters, and removing pollutants from the water through natural physical, chemical, and biological actions. These natural areas are lost through activities such as construction. A "mitigation" wetland, a wetland area created from farmland, is required by government regulations to compensate for this loss. Research at Tuskegee University deals with the quantification of three wetland attributes—vegetation, hydrology, and soils—in several mitigation wetlands in Alabama. Inventory of natural vegetation and planted species on the wetland site and an analysis of the usefulness of tree shelters, or tubes, in the growth of saplings sowed abundance of vegetation a high survival rate of planted species. The hydrology measurements of water level below the ground surface with shallow wells showed the water table of at least two feet below the surface across the site and the analysis of the soils revealed the presence of hydric or waterlogged soils at the sites near the shallow hydrology wells. Results thus far indicate the progress of the wetland mitigation.

Goal 5: Enhance Economic Opportunity and Quality of Life for Americans

State Program 5: Ensure Socioeconomic and Self-Empowerment of Families and Communities

Overview

One-fourth of the American population lives in rural areas. Alabama is 45% rural, based on 2000 census data. Further, the Black Belt Counties (BBCs) of south central Alabama, which extend from the Georgia border in the east, to the Mississippi border in the west, pose a unique challenge for the land-grant system due to the demographic, social, and economic distinction of the region. The well-being and societal contributions of this population hinges on having viable communities, businesses and economies. This viability becomes significantly important in rural communities where the majority of the residents are poor.

Forces of change continue to dramatically affect rural areas and communities including exposure to global economic trends, technological revolution, and diversification of community economic foundations formerly almost entirely dependent on agriculture and other extractive industries. In this changing context, there is a serious concern about the fate of the rural communities and the underserved, particularly in the Black Belt region of Alabama. Based on the historical nature of underdevelopment for this region, while at the same time acknowledging specific areas of potential for development, research at Tuskegee University focuses on the assessment of the

current measures for economic growth, equity issues and quality of life indicators as elements of sustainable rural development in the Black Belt of Alabama.

At Auburn University, research is being conducted on natural resource and environmental issues that affect the rural populations of Alabama. Another major research area is in the identification of issues that affect marriages and families in Alabama and to better understand the patterns of consistency and change in marriages.

At Alabama A&M University, programs are designed to ascertain the impact of technology and sustainable agriculture practices on the well-being of farmers, particularly small- and medium-sized farms in Alabama. The research results have provided information on areas of the small-scale and limited-resource farm that can be targeted for value-added programs and be assisted by access to and participation in specific USDA programs.

Outcomes of the research under this goal will enable the forestry industry in the state to support more effectively rural development in the state and assist farmers in developing sustainable farming practices and other enterprises.

Allocated Resources ($) and Scientists Years (SY) for State Program 5

Inst.	FY 2000		FY 2001		FY 2002		FY 2003		FY 2004	
	Approx. Expend.	SY	Approx. Expend.	SY	Approx. Expend.	SY	Approx. Expend.	SY	Approx. Expend.	SY
1862 (AL)	1,218,759	5	1,149,524	3	1,207,000	3	1,267,350	3	1,267,350	3
1890 (ALAX)	135,110	1	383,670	2	402,853	2	422,995	2	444,144	2
1890 (ALX)	505,304	3	268,819	3	301,159	3	316,216	3	332,026	3
Totals	1,859,173	9	1,802,013	8	1,911,012	8	2,006,561	8	2,043,520	8

Key Theme: Economic Viability and Sustainable Communities

Statement: Tuskegee University researchers continue to focus on the economic viability of the Black Belt counties of Alabama in efforts to enhance socioeconomic well-being and self-empowerment of families and communities, particularly underrepresented minorities (African-American, Native American, and Hispanic/Latino farm families). Critical factors necessary for sustainable rural community development are being investigated, including factors that apply to resource development (e.g., land loss and retention), economic development (e.g., small business and micro enterprises), and socio-political development (e.g., access and equity issues). Specifically, the land loss phenomena and efforts to recoup it continue to be a challenge for African American farmers and other minority communities in Alabama and the rural south. Sustainability of related farm and other small business operations depends on factors and program or policy initiatives that are undertaken by governments (federal, state and local), community based organizations and engaged institutions such as Tuskegee University. In terms of land loss, research results suggest that the Class Action Lawsuit did not make a difference in Black farmer participation in the USDA loan programs, technical assistance programs, and other support programs as mandated by the settlement terms; the settlement money helped to improve productivity and profitability of those who received awards; and farmers strongly believed that they received inadequate information about the lawsuit and the process to get the settlement money. The settlement money was not enough to cover Black farmer losses endured for years of

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discrimination. It is expected however that USDA would gradually revise policies about representation of minorities in the FSA County Committee System. In terms of community initiatives, the use of enterprise facilitation in select minority communities reveals that initial seed/grant resources, staff support, and continued one-on-one technical assistance for a minimum of five years might lead to a successful local/community land ownership and a strategic development plan in place for Native American and other minority communities. In terms of business development, vendor or wholesaler-owner or retailer relationship, residence of the owner, ability or capacity to generate cash flow, and years in business had an impact on sustainability/viability of small businesses in the local/minority communities. Outreach efforts through the Small Farm Project, Rural Business and Economic Development Program, the Center for Minority Land and Community Security, the Cooperative Extension Program, and other initiatives have resulted in greater success in the Class Action Lawsuit for Alabama farmers, more estate planning tools in place for farm families, increased loan applications for small farm and business owners, land ownership and development plan for the Cherokee Tribe of Northeast Alabama, initial/seed resources for more than 10 community-based organizations and other local enterprises.

Statement: Through the Center for Minority Land and Community Security, Tuskegee faculty and staff, along with land grant and community-based organization partners, work to enhance and empower rural minority communities by addressing land tenure issues, land-based legal services, conflict resolution, youth leadership development and farm and community economic development issues. These issues are addressed through technical assistance and value added product development, legal extern placements, workshop-based training sessions, annual youth summits, participatory community research, and topical video productions. The Center has increased the knowledge base and level of activities in rural African American, Hispanic, and Native American communities regarding land retention issues. The center has provided almost 400 professionals and paraprofessionals with tools to provide land retention-related services to their communities. The Value Added Demonstration Project assisted farmers in northern New Mexico and southern Colorado organize cooperatives and market crops in an effort to restore the viability of family scale farming. The project created a business structure that allows producers of organic and chemical-free food to enhance their marketing, purchasing and bargaining power. The Conflict Resolution Project continued to provide training to community practitioners. The Land Use and Resource Methodology Program worked with the Cherokee Tribe of Northeast Alabama in an endeavor to purchase 10 acres of land that the tribe is utilizing to build and operate an RV park in its economic development efforts. The tribe purchased the land with an option of purchasing an additional 100 acres in the future. The project is assisting with a business plan and is providing a staff person to the tribe to assist with the acquisition plan and implementation. The program is working with a community board of the Camden Community Youth Development Center to develop and implement a plan to provide a stream of income to make the mortgage payments on the newly constructed community center and to build a gymnasium at the multi-use facility. A third project was developed to assist the Tuskegee-Macon County CDC with a plan for real estate development. The Cooperative Land Retention Summit and the Youth Land Summit both allowed members of rural African American, Hispanic, and Native American communities to share and strategize on ways to work as communities to preserve land bases. The center has participated in providing training and technical assistance to other organizations working to maintain minority farmers and families on their land base.

Statement: Tuskegee University and partnering scientists have pioneered the investigation of systems that influence financial and other resources necessary to revitalize Black land ownership and surrounding communities. The overall purpose of this research project was to conduct a historical assessment of seven all-Black agricultural resettlement communities located in the rural

South. This assessment examined the impact of government programs on land ownership and land loss in farm survival as well as those elements that lead to long-term community survival. Approximately 700 former participants, their descendants, community leaders, former students, former teachers attended this historical event. Assistance was provided to the Flint River Farms agricultural resettlement project in the completion and submission of a Georgia historical marker application package. The community received notification in September 2004 that their application package was approved. This research project has had a significant impact on the lives of the participants, their descendants, former students, former teachers, and community members. It has contributed to the knowledge base regarding black land ownership and has addressed the significance of partnering with government agencies and universities in addressing the myriad of social, economic, and educational issues facing rural communities. This project has also highlighted individual initiatives in breaking tradition-bound barriers regarding social norms that excluded all residents in these southern communities from fully pursuing the American dream. This project has also laid the foundation in which individual communities can preserve their past for future generations and acknowledge the achievements of the local residents who stepped out on their faith to pursue a dream of independence, self-sufficiency, and self-reliance by participating in these seven agricultural resettlement projects.

Statement: The principles and policies necessary for rural communities and non-metropolitan counties to act optimally in response to the entrance of new, large industrial plants are not clearly established. Researchers at Auburn University are collecting data that will provide guidance about the evolution of development opportunities in those communities and counties adjacent to industrial plants. Currently, response to new plants and any "spillover" effects are random, reactive, passive, and unguided. If the appropriate policy framework was in place, adjacent communities to new industries could benefit substantially through employment growth.

Key Theme: Families and Children

Statement: The state of Alabama has the fourth highest divorce rate in the US; which means that a significant number of children experience the divorce of their parents, and many also must adjust to subsequent remarriages. Researchers at Auburn University are studying expressions of mothers' and fathers', particularly on how parents express positive and negative emotions. These expressions were found to be related to the development of emotional intelligence in children, which in turn were associated with interactional patterns in the later romantic relationships of the children. Socialization experiences in the family provide both models of emotional expressiveness as well as skills in how to relate interpersonally, which in turn predict relationship outcomes.

II. Stakeholder Input

Stakeholder input into the planning and priority setting of Alabama's Agricultural Research Programs (AARP) is continuous and includes formal and non-formal processes. The formal process includes conducting statewide surveys of citizens, commodity and advisory groups, farmers, urban and rural families, faculty and students, and policymakers. Additionally, input is sought through the Annual Farmers' Conference, the Professional Agricultural Workers Conference, the Annual Agriculture Week, Advisory Councils, and the six Research and Extension Centers throughout the state in conjunction with the Alabama Cooperative Extension System (ACES), including the Tuskegee University Extension Program. Farmers and other key constituent groups have input via their respective associations and commodity groups. The

Associate Directors of the AAES (the Deans of the associated academic school and colleges at Auburn University), and the Research Directors at Alabama A&M University, and Tuskegee University, have their own Advisory Councils who provide counsel on research program directions. Stakeholder input aids in identifying and addressing the needs of the under-served and under-represented populations in the state. Stakeholder input is also from the Alabama Cooperative Extension System's very comprehensive stakeholder process that utilizes a network of 67 county extension advisory boards and county and state-level program advisory committees. In January, February, and May, 2004, 7 stakeholder sessions were held in Montgomery and at the Auburn University Research and Extension Centers across the state. Attendees included over 300 producers, faculty, industry leaders, extension specialists, and citizens. Additionally, input was received via a web-based survey regarding regional initiatives and needs.

III. Program Review Process

The Research Directors ensure that the Merit Review Process for 1890 Evans-Allen Research Proposals remain consistent with guidelines published in the Administrative Manual for Evans-Allen Cooperative Agricultural Research (Sec C: Program Administration, Subsection 2b: Project Approval Procedures-Merit Review, p. 5).

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The Director of the Alabama Agricultural Experiment Station and other administrators ensure that projects and programs are merit-reviewed and that they adhere to criteria listed in the Administrative Manual for the Hatch Act, as amended.

IV. Evaluation of the Successes of Multi- and Joint-Activities

The Alabama Agricultural Experiment Station and the Alabama Cooperative Extension Service have many joint activities and the research portions of the integrated activities are supported by Auburn University through formula funds. Extension programs are supported through Smith-Lever formula funds and are reported under a separate Plan of Work. The research components of these integrated projects are representative of the five state programs identified in the Alabama Agriculture Research Program's Five-Year Plan of Work and coordinated with the USDA REE goals. The amount of Hatch funds committed to each goal is listed as follows: Goal 1, $1,620,453; Goal 2, $93,432; Goal 3, $213,141; Goal 4, $764,971; and Goal 5, $227,739.

V. Integrated Research and Extension Activities

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The following are included to document integrated research and extension activities. Form CSREES-REPT is included as an Appendix and the FY 2004 Integrated Research and Extension Activities Project Summaries are presented below.

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PROJECT SUMMARIES, FY2004

Title: **A National Agricultural Program to Clear Pest Control Agents for Minor Uses**
A number of herbicides were tested for use on ornamental plants that do not have a predominant market. Several herbicides are found to be quite effective, but some phytotoxicity is observed on some crops.

Title: **Accelerated Flowering, Chilling Requirements, and Growth Regulation of Herbaceous Perennials**
Studies are on-going on the chilling requirements of various perennials. These studies will help growers in maximizing growth of their plants, as well as identifying when to prune or otherwise treat plants in order to minimize possible cold injury.

Title: **Alternative Tillage and Soil Fertility Management Practices on Peanut Seed Quality and Yields**
Row patterns for peanut production are being evaluated, and results indicate that a twin-row planting pattern will result in greater yields than a single row; and there is not an advantage to triple-row planting patterns. In another study, ash from burning of poultry litter (an agricultural waste product) is being evaluated as a source of phosphorus and potassium fertility for forage crops.

Title: **Animal Manure and Waste Utilization, Treatment and Nuisance Avoidance for a Sustainable Agriculture**
Studies are progressing on manure management through soil incorporation using different tillage systems. Preliminary results indicate that carbon dioxide emissions are greatest when manure is incorporated into soil with conventional tillage practices. Laboratory studies have indicated that enteric pathogens in manure can be eliminated by adding calcium oxide.

Title: **Avian Respiratory Diseases: Pathogenesis, Surveillance, Diagnosis and Control**
Of most significance, work on this project has involved the compilation of a bacterial library by which the sources of infection can be identified. Thus, when a problem arises in some part of chicken processing, the origin of the bacterial contaminant can now be identified and cleaned at the source.

Title: **Cultural Practices and Cultivar Evaluations for Pecans**
Pecan cultivars have been identified that perform well with minimal input, especially relative to chemical insect and disease control.

Title: **Decision-Making Under Uncertainty and the Economics of Risk in Alabama Agriculture**
Studies have been conducted on the appearance versus price of Satsumas that consumers find acceptable.

Title: **Epidemiology of Plant Diseases in Crop and Urban Landscape Ecosystems**
On-going work on aflatoxin contamination of peanut indicates that several species of plant parasitic nematodes can contribute to this problem. Studies indicate that rotation is a cost-effective means of reducing nematode populations.

Title: **Improving Yield and Quality of Selected Cucurbit and Solanaceaous Crops in Alabama**
A multi-year study has shown that sowing cover crops in the fall prior to pumpkin production could increase yields by about 25%. In addition, nitrogen application up to 45 lb/a increased yield.

Title: **Integrated Sustainable Production Practices for Cotton (*Gossypium hirsutum*)**
This study continues to evaluate the most efficient means to management different cotton cultivars.

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Title: **Management of Arthropod Pests on Peanuts**
The demonstrations that are part of this study show that aldicarb- or phorate-treated peanuts have a lower incidence of tomato spotted wilt disease than untreated peanuts. In addition, the cultivar C3424 appeared to be more susceptible to thrips damage than other cultivars that were evaluated, including Georgia Green, Ga02C, AP-3, C99R and others.

Title: **Management of insect pests of forage and grain crops in Alabama**
Studies are continuing on assessing new seed insecticides for control of Hessian fly on wheat. While many of these products effectively decrease fly infestation, wheat yields were not significantly impacted. Green June beetle in pastures is also being studied, and has been found to be associated with sites with higher organic matter.

Title: **Systems for Controlling Air Pollutant Emissions and Indoor Environments of Poultry, Swine, and Dairy Facilities**
Newer poultry house construction techniques, wider clear span technologies, and improved in-house environmental control equipment and monitoring systems have been studied to ascertain optimal poultry farm construction approaches. Poultry house heating alternatives to propane (fuel, air and ventilation management, and insulation) have been studied to improve in-house bird environment, improve flock performance, improve air and litter quality, and reduce heating/brooding expense to growers.

Title: **Technical & Economical Efficiencies of Producing, Marketing, and Managing Environmental Plants**
This study has demonstrated that costs continue to increase for commercial sod producers, but increases are somewhat less for larger producers. Thus, some sod producers may need to expand in order to maintain profitability. Branding, as a means of creating or marketing, can also help with profitability.

Title: **Termite Behavioral Ecology and Enhancement of Integrated Approach Toward Termite Management**
Research on this project has indicated that the most rapid spread of Formosan termite has been due to man's movement of infested materials – specifically infested railroad ties. Other work is demonstrating that termites can get used to frequent disturbances, such as checking bait traps, and this will not detract from bait station effectiveness. In addition, lab trials indicate that the Formosan termite is more aggressive than our native termites, and these two termites will not mix in nature.

Title: **The Ecology of the Mobile-Tensaw Delta: An Ecotone between Marine and Freshwater Ecosystems**
This on-going study on bass in Alabama waterways is indicating that while winter survival of young bass is fairly low (~ 50%), those that do survive also increase in length through the winter. Most growth occurs, however, in autumn months.

Title: **The Poultry Food System: A Farm to Table Model**
Transportation of chickens, especially physically carrying the birds, prior to slaughter is being shown to increase meat defects such as bruising, blood contamination, and darkening of the meat. This effect was similar among breeds. Tests show that younger birds are less affected by transportation, and improving conditions can reduce meat defects due to transportation.

Title: **Water Quality Issues in Poultry Production and Processing**
This project aims to identify alternative materials and uses of bedding materials in chicken production. Sand was found to be acceptable as a bedding material and might be maintained and cleaned out on a schedule more conducive to re-sale to landscapers. More traditional bedding such as pine shavings could be burned, thus providing fuel for temperature control and the ash could be re-used to supplement feed.

VI. Multi-State Extension Activities

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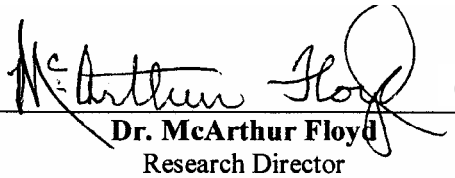
These activities are reported under the Five-Year Plan of Work from the Alabama Cooperative Extension System.

Certification of the *Annual Report of Accomplishments and Results for Alabama Agricultural Research Programs*, Federal Fiscal Year 2004:



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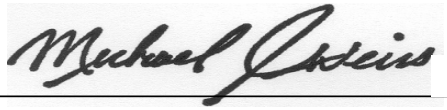
Dr. McArthur Floyd
Research Director
School of Agricultural and Environmental Sciences
Alabama A&M University



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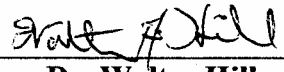
Dr. Michael J. Weiss
Dean and Director, College of Agriculture
and Alabama Agricultural Experiment Station
Auburn University



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Dr. Walter Hill
Dean and Research Director
College of Agricultural,
Environmental and Natural Sciences
Tuskegee University

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APPENDIX