# 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
**2005**

**October 1, 2004 – September 30, 2005**

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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 annually since FY 2002.

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. Richard Guthrie* (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 Dr. Richard Guthrie or his designee, 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 2005 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 and the development of transgenic sweetpotato plants with 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. For example, these programs have demonstrated that animal rearing procedures can affect the quality of the end product and include developing higher yielding cotton cultivars that can be produced at lower costs than current cultivars.

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 medicinal and alternative specialty crops.

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

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

| Inst. | FY 2000 | | FY 2001 | | FY 2002 | | FY 2003 | | FY 2004 | | FY 2005 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Approx. Expenditures ($) | SY | Approx. Expendi-tures ($) | SY | Approx. Expendi-tures ($) | SY | Approx. Expendi-tures ($) | SY | Approx. Expendi-tures ($) | SY | Approx. Expendi-tures ($) | SY |
| **1862 (ALA)** | 15,411,148 | 56 | 13,957,013 | 42 | 14,654,863 | 42 | 15,378,606 | 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 | 1,712,640 | 8 |
| **1890 (ALX)** | 775,250 | 6 | 820,938 | 6 | 861,984 | 6 | 793,524 | 6 | 809,394 | 6 | 825,582 | 6 |
| **Totals** | 17,433,398 | 69 | 14,918846 | 56 | 16,220,501 | 56 | 17,837,105 | 56 | 17,819,086 | 56 | 17,916,828 | 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. Anthocyanins and and phenolic compounds including resveratrol have been identified in muscadine grapes. 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. This information is being used to in the development and implementation of community nutrition education programs. 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**: Researchers at Auburn University are examining the biosynthetic pathways associated with Vitamin B6 content in plants. This work could provide the foundation for improved Vitamin B6 content in various plant commodities.

**Key Theme: Economics**

**Statement**: In order for agricultural commodities to maintain competitiveness in a global market, production levels must be reliable and consistent in quality. Regions or communities that have resource dependent economies, such as timber production or coal-mining, have been shown to be vulnerable to disruption by natural events or accidents in work done by Auburn researchers. This vulnerability can be reduced by diversifying locally and strengthening local educational systems.

**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 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 was named and 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. Studies on a comparative map between peanut and soybean to better characterize resistance genes in peanuts that are difficult to work on at the molecular level is still in progress. 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 role 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. Studies are in progress on the identification of genes responsible for root initiation and enlargement.

**Statement:** Tomato spotted wilt (TSW) disease of peanut is considered one of the greatest problems in production of this crop. This disease is especially devastating because management options are limited. However, peanut cultivars are being developed and evaluated by Auburn researchers, and these cultivars show promise of high yields even when TSW pressure is high. The better cultivars from these trials show an estimated 400 lbs/Acre yield increase, or $71.00/acr gain compared to a current cultivar favorite.

**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 constructed a cDNA library and screened it with probes to identify genes conferring high fiber quality. Approximately 200 primers were constructed to screen cotton genotypes. Thirty-two primers produced successful amplification products. DNA was extracted from 24 euploid chromosomes substitution lives from *Gossypium barbadense, G. hirsutono* and 36 accessories of cotton wild species. These fiber-associated gene expressions in *G. barbadense* are leading to better understanding of the mechanism of fiber development in cotton and are being pursued diligently by researchers.

**Statement**: Genetic engineering offers hope for understanding 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 an integrated approach to understand this problem by studying the functional and evolutionary aspect of the plant-reniform nematode interactions through the use of genomics and bioinformatics. Currently, populations of reniform nematodes have been established in the greenhouse; several primer pairs have been subjected to nematode DNA amplification; and preliminary procedures for developing quantitative assays using real-time PCR apparatus have been developed.

**Key Theme: Improved Poultry Systems**

**Statement**: In order to optimize returns in agriculture production, input costs can be decreased or output levels can be increased. For poultry producers, Auburn University researchers are evaluating several new technologies that can decrease input costs and improved production. For example, alternatives to propane for heat and use of improved environmental control technologies, are being examined. Reductions in heating and

brooding expenses, coupled with increased liveweight production, are being demonstrated for poultry growers who adopt these technologies.

**Statement:** Tuskegee University scientists continue their studies on 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. Studies also are in progress to isolate the the apo B (associated with LDL) and the cox 2 genes from the cardiomyopathic turkeys.

**Key Theme: Improved Animal Systems**

**Statement**: Livestock will continue to be a meat source, and savvy consumers continue to desire tender cuts. At Auburn University, researchers are studying the expression of genes of swine fed diets of varying fat content. Resultant information will allow greater understanding of how to modify juiciness and marbling in pork muscle for meat.

**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, kudzu 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 shown that browsing tends to reduce parasite load and can decrease use of anthelmintics when compared to grazing on conventional forages. Results also show that copper supplementation in the diet could offer a means of altering lipid profile as well as content. 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**: The demand for canola oil is increasing and the U.S. is importing over 80% of the oil for domestic use. Researchers at Alabama A&M University have established cooperative linkages with several canola researchers/breeders in the U.S. and have developed 70 advanced breeding lines. They have also selected a range of varieties suitable for production in the SE in general and Alabama in particular. Agronomic practices such as optimum date of planting and seeding rate, and fertility levels have been established. Field research on sustainability of canola as a double crop and in rotation with major summer crops (i.e., cotton, corn, sorghum, and soybeans) has been completed pending final analysis of data.

**Statement**: Auburn University researchers have been studying sunnhemp (*Crotalaria juncea L.*) for its potential as a new crop in the Southeast U.S. Sunnhemp is widely grown in the tropics, but has not been favored in the U.S. because of reports that it produces alkaloids with toxicity to animals. An Auburn researcher has tested nine plant introduction populations for alkaloid content and found that seeds of this plant may not be as toxic to animals and birds as thought. Results indicate that sunnhemp could be developed as a new crop for the Southeast.

**Key Theme: Fisheries and Aquaculture**

**Statement**: Red snapper is one of the most important fish in the commercial and sport fisheries of the Gulf of Mexico, and is becoming over-fished. Auburn researchers are studying varying factors that affect egg and larval quality which will lead to improved availability of the fish. Results from work in fish nurseries have shown that larval quality can be improved by providing additional free amino acids and that addition of alternative live foods, such as *Fabrea salina*, improve larval survival.

**Key Theme: Water Availability and Quality**

**Statement**: Tuskegee scientists are evaluating the effect of tillage and cropping practices on water quality, selected soil factors and enzyme activities in 8 watersheds in Alabama. These factors have been proposed as possible early indicators of ecosystem sustainability. Results indicate that land use significantly affected soil pH and organic matter. Tillage practices resulted in lowering the organic matter content with concomitant decrease in soil pH. The activity of phosphatase enzyme in the soils was significantly affected by land use patterns. Soils under native grass which received minimum tillage generally had significantly lower phosphatase activity than soils that received conventional tillage. Soil organic carbon content was positively correlated with activities of all the phoshatases studied. Phosphodiesterase and alkaline phosphatase activity were significantly correlated with both pH and a soil organic carbon. No correlation was found between arylsulfatase activity and land use, pH, organic matter and the phosphatases. Tillage activities generally decreased organic carbon content however minimum tillage combined with maintaining soil under native grass increases soil organic matter content. The use of soil enzyme activity as an indicator of soil quality will allow early detection of adverse affects due to soil management and provide land managers access to a very simple and efficient tool in that management. These studies will also help to develop agricultural management systems that will contribute to protecting 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**: Water quality impairments to Flint Creek Watershed due to both point and non-point sources were documented in 2002 (USGS 2002). Approximately 25 miles were impaired due to the presence of nutrients, organic enrichment areas, feedlots, and dairies (The Flint Creek Watershed Project Final Report, 1995). Researchers at Alabama A & M University collected bi-weekly water samples to determine their water quality parameters including: nutrients, heavy metals, feed coliform bacteria, chlorophyll, turbidity, dissolved oxygen, and biological oxygen demand from 2003 to the present. Statistical evaluation of data showed a significant difference between means for the years. Mean coliform bacterial (CF) counts and concentrations of turbidity, BOD, Cd, Cr, Ni, Pb, and Zn were significantly higher during the 2004 monitoring period. Methods for modeling key TMDL parameters (i.e., heavy metals, sediments, biological indicators, dissolved oxygen are being synthesized to aid decision-maker in improving TMDLs.

**Statement:** As irrigated land in the western US decreases and competition for water sources in the southeast increases, interest in off-stream reservoir water storage is increasing. Alabama and other southeastern states are in a good position to store and utilize large freshwater flows during the wet season, then use these water resources during the growing season for conjunctive uses, including irrigation and public water supply. Research at Auburn is demonstrating the potential value of using reclaimed wastewater for golf course irrigation to increase the utilization of an existing water resource in an environmentally friendly manner.

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

**Statement**: Alabama A&M University scientists, in a consortia arrangement with Tuskegee University and nine other Historically Black (1890) Land-grant Universities, addressed the educational deficit of agricultural biotechnology in underserved communities of the south. Forty-three teachers and, through them, more than

1000 students in 55 high schools located in 55 underserved counties were trained in biotechnology. Seventeen different varieties of seven vegetable crops were demonstrated (i.e., biotech-based and conventional crops) to limited resource farmers. Over 20 educational biotechnology activities-field days, workshops, and one-day symposia were conducted for farmers, community leaders, teachers, students, and consumers. Over 3000 surveys on consumer attitudes regarding biotechnology were completed to assess producers, consumers, and student perception, acceptance, and understanding of biotechnology in underserved communities.

**Statement**: Research at Auburn University has been evaluating how changes in the Social Security retirement system might affect the well-being of farm families. Analysis has indicated that, for the average farm family additional savings will be required to substitute a government backed annuity with a private annuity.

**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. In Ghana, a nutritional enhancement program was developed and targeted at farm families in the Volta, Central and Northern regions 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. Tuskegee University continues its efforts in the training and capacity building of 16 African countries in sanitary and phytosanitary procedures in risk assessment in efforts to increase these countries' ability to export food products to the US. Over 120 scientists from these countries have been trained so far in risk assessment. Tuskegee University is also involved in training scientists in several African countries on effective communication of biotechnology issues and awareness to policymakers and the public. Regional training workshops are being conducted in Africa. Further, scientists at Tuskegee University are involved in training scientists from four Western African cotton growing countries (C-4 countries) in soil management and Integrated Pest Management (IPM) for cotton.

## 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 continue with efforts to rapidly detect microorganisms in food that have the potential to cause illness, as well as ways in which to reduce these organisms. Analyses of various policies (e.g., GATT, tariffs) on agricultural production have also been conducted. 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. Researchers at Alabama A&M University remain 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 | | FY 2005 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Approx. Expend-itures | SY | Approx. Expend-itures | SY | Approx. Expend-itures | SY | Approx. Expend-itures | SY | Approx. Expend-itures | SY | Approx. Expend-itures | SY |
| **1862 (AL)** | 4,837,516 | 23 | 3,928,689 | 13 | 4,112,123 | 13 | 4,331,380 | 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 | 131,718 | 1 |
| **1890 (ALX)** | 219,793 | 2 | 239,971 | 3 | 251,969 | 3 | 275,359 | 3 | 283,619 | 3 | 292,128 | 3 |
| **Totals** | 5,253,509 | 26 | 4,285,525 | 17 | 4,486,800 | 17 | 4,724,790 | 17 | 4,745,284 | 17 | 4,755,226 | 17 |

## Key Theme: Food Safety – Animal Products

**Statement**: Alabama A&M University scientists evaluated 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. Several dyes (i.e., Sudan 4 and Tryptophane blue) were tested for their proficiency in differentiating the individual leaves of liposomes and the presence of encapsulated BHA. These tests were unsuccessful, dyes did not fluoresce. However, Glycine and Acridine orange both fluoresced and were able to highlight the liposomal vesicles. Additionally, the encapsulated BHA remained as effective in preserving ground meat quality as was previously reported. Rancidity (TBARS) was significantly reduced over the storage period compared to unencapsulated BHA treated and untreated (control) samples.

**Statement**: Mosquito-transmitted viruses pose a threat to animal health in many parts of the USA, and Auburn University researchers have been working to learn more about the life-cycles and ecology of these mosquito-virus systems. One discovery is that *Culex erraticus* females that hibernate in coolest months (January-March) may maintain West Nile virus for year-to-year spread.

### 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 and production of these crops, researchers at Tuskegee University are using biological methods to control post-harvest problems. 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. Results thus far indicate that *R. minuta* was very effective in controlling Rhizopus soft rot in tomatoes. The orientation of irradiated fruits and vegetables following low dose ultraviolet light –C treatment induced resistance to decay of selected fruits and vegetables. This is important because this can reduce the chemical application to prolong shelf-life and reduce post-harvest losses.

**Statement**: Contamination of produce (such as lettuce, tomato, and strawberry) by the human pathogen, *Giardia lamblia*, can be a problem in today's global market. Research at Auburn has shown that such produce, containing known concentrations of Giardia cysts, is decontaminated when irradiated with 0.5 kilo-Gray cobalt-60. Lower doses of this gamma irradiation will reduce pathogen load but not eliminate it. This result can contribute to safety of the foods we eat.

**Key Theme - Food Safety and Risk Analysis**

**Statement**: Studies at Auburn University are evaluating the effects that pollutants have on plants. In one study, changes in the nutritive value of red and white clovers for animal consumption are being evaluating when these plants are exposed to the air pollutants, ozone and carbon dioxide. Results indicate that ozone diminishes the nutritive quality of these species irrespective of carbon dioxide levels.

## 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 continue to focus their research program 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 | | FY 2005 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Approx. Expend-itures | SY | Approx. Expend-itures | SY | Approx. Expend-itures | SY | Approx Expend-ituress | SY | Approx. Expend-itures | SY | Approx. Expend-itures | SY |
| **1862 (AL)** | 2,227,188 | 4 | 1,977,742 | 10 | 2,222,355 | 10 | 2,333,769 | 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 | 170,189 | 1 |
| **1890 (ALX)** | 164,785 | 1 | 174,439 | 2 | 183,160 | 2 | 192,318 | 2 | 201,933 | 2 | 205,972 | 2 |
| **Totals** | 2,526,123 | 6.2 | 2,292,198 | 13 | 2,579,532 | 13 | 2,680,454 | 13 | 2,697,787 | 13 | 2,709,930 | 13 |

**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 diet were developed through focus groups and are being distributed in the target communities.

**Statement**: The nutritional quality of fruit and vegetables during storage is becoming increasingly important along with recognition of the importance of these foods in human diets. In studies at Auburn University, four commodities (blackberry, kiwi, satsuma mandarin and strawberry) have been assayed for their antioxidant characteristics as affected by various pre- and post-harvest stress factors under Alabama growing conditions. Preliminary findings from these studies have shown that the nutritional and antioxidative properties, as well as shelf-life, may be retained by basic postharvest practices including improved cultivar selection, application of wax coatings and hot water treatment for disinfestation.

**Key Theme - Diet Modification for Targeted Populations**

**Statement**: Fish are rich in long chain long chain polyunsaturated fatty acids which, when consumed, can decrease blood pressure and the risk of coronary heart disease in humans. However, fish can also be a source of environmental pollutants such as methylmercury. Research at Auburn University, using laboratory rats, is indicating that fish oil in the diet prevents an increase in blood pressure with age only in the absence of methylmercury. These results suggest that methylmercury contamination in foods should be of concern particularly for groups with a risk for coronary heart disease.

## 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. Productivity of Alabama's agricultural, silvicultural, and other natural resource-dependent industries will be sustainable only with immediate and long-term efforts to maintain quality. In a sustainable agricultural system, animal, poultry and crop production residues and wastes might 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 with high levels of trace elements 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. Analysis of variance showed no significant difference in the protein content of Shiitake grown on sweet gum logs based on type of nitrogen solutions, rate (i.e., 0, 3, and 6g N/L water) or soaking period.

The ultimate goal is to design effective broiler litter management strategies for the different soil types in Alabama. 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.

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

| Inst. | FY 2000 | | FY 2001 | | FY 2002 | | FY 2003 | | FY 2004 | | FY 2005 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Approx. Expend. | SY | Approx. Expend. | SY | Approx. Expend. | SY | Approx. Expend. | SY | Approxi. Expend. | SY | Approx. Expend. | SY |
| **1862 (AL)** | 12,538,179 | 36 | 11,825,926 | 38 | 12,417,222 | 38 | 13,038,083 | 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 | 112,567 | 1 |
| **1890 (ALX)** | 324,802 | 2 | 268,414 | 2 | 281,834 | 2 | 215,619 | 2 | 222,087 | **2** | 226,529 | 2 |
| **Totals** | 13,051,181 | 39.5 | 12,186,950 | 41 | 12,796,296 | 41 | 13,436,109 | 41 | 13,367,377 | 41 | 13,377,179 | 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 the long-term effects on ecosystems of broiler litter applications to agricultural lands. Results of our studies have indicated that the effects of trace elements on nitrogen transformation varied from soil to soil. 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.

**Statement**: Better adapted plant selections are expected to require fewer pesticides, cultural, and water inputs to maintain a commercially and aesthetically valuable landscape. At Auburn University, the water-use patterns of hybrid bluegrass and tall fescue cultivars are being evaluated. Results show that two hybrid bluegrass cultivars were able to survive stress periods better than the tall fescue cultivars. In addition to water use efficiency, research continues to show that hybrid bluegrass has better turf quality and shade tolerance than turf-type tall fescue cultivars. Landscapes planted to these cultivars will do well without substantial amounts of inputs, and can contribute to water-use conservation.

**Statement**: Scientists at Alabama A&M University have evaluated the impact of poultry waste applied to land. 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. Results indicate that the various P forms decreased with soil depth and were significantly (P,0.01) affected by season with the lowest phosphatase activity occurring in the fall. 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 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**: Studies are continuing at Auburn University on the effects that crop rotation has on soils, particularly for those rotations that include bahiagrass. Results show that bahiagrass does enhance soil conditions. For example, earthworm activity and water infiltration have been found to be greater in row crops following one year rotation to bahiagrass. Soils also tend to have decreased levels of nitrates and ammonium following rotation to bahiagrass.

**Key Theme: Urban Issues**

**Statement**: Research at Auburn University is evaluating land use changes that may put farmland at risk of conversion in the future. Factors that affect this risk include house values, toxic releases in the area, and labor productivity. Information arising from this work can help communities make land-use zoning decisions.

**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. Use of biodegradable Master–Bi film plastic mulches resulted in a 5 degrees centigrade increase in temperature and the mulches were completely degradable after the growing season. 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**: Barley yellow dwarf disease is a problem affecting small grain production throughout the world. This disease is caused by several viruses, which are vectored to plants by several aphid species. Because of the complexity of the relationships between the aphid species, differing virus isolates, and potentially varying reactions of plant cultivars to infection, management of this disease is difficult. Research at Auburn continues on evaluations of insecticidal products, timing of applications of insecticides, and cultivar reaction to infection by naturally-occurring viruses. Results indicate that cultivar choice is important, particularly since insecticide application is not always successful.

**Statement:** Insect pests continue to be important production constraints on vegetable crops grown by limited resource farmers in many parts of the southern US. Research at Tuskegee University continues to seek improvement in the production and utilization of sweetpotato by reducing loss caused by the insects and diseases an integrated pest management approach. Information from these studies will be used to design pest management strategies to reduce pesticide use. A regional risk assessment of the weevil and a study of pest profiles on sweetpotato show that the overall risk of spread of weevil to non-infested areas is small (ca. 2%) as long as the recommended pre-post harvest mitigation procedures are observed. However, this risk could increase to 26% or greater if no mitigation is undertaken. These studies continue to provide information on the movement of the sweetpotato weevil and the potential risks of spread to uninfested areas, and how this would impact the management and quarantine regulation of sweetpotato movement in the state.

**Key Theme: Remote Sensing and Precision Agriculture**

**Statement**: Auburn University researchers continue to work cooperatively with forest industry companies to develop a diameter sensing system for tree-length felling equipment. One effort is on relating variability in timber yield maps to site characteristics. Over 2300 trees have been measured and mapped and correlations calculated between tree size and slope and a compound topographic index. Results show that other factors need to be explored to explain tree growth potential.

**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. At Auburn University, research continues on stress levels on white-tail deer populations. Recent results indicate that predation on the deer is higher than previous estimates. This information could affect hunting regulations in the state.

**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 showed an abundance of vegetation and 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 of continuous monitoring indicate positive 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, however, is 45% rural, based on 2000 census data. The rural 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 continue to focus 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. Research Studies at Alabama A & M University have been 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 | | FY 2005 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Approx. Expend. | SY | 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 | 1,267,350 | 3 |
| **1890 (ALAX)** | 135,110 | 1 | 383,670 | 2 | 402,853 | 2 | 422,995 | 2 | 444,144 | 2 | 466,351 | 2 |
| **1890 (ALX)** | 505,304 | 3 | 268,819 | 3 | 301,159 | 3 | 316,216 | 3 | 332,026 | 3 | 348,627 | 3 |
| **Totals** | 1,859,173 | 9 | 1,802,013 | 8 | 1,911,012 | 8 | 2,006,561 | 8 | 2,043,520 | 8 | 2,082,328 | 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). Investigations on critical factors necessary for sustainable rural community development included those 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). 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. Outreach efforts through the Small Farm Project, the Rural and Economic Development Program and the Extension Program have led to the development of the farmers markets in Tuskegee and Selma becoming more sustainable, with more produce being sold and receipts reported. There was a record 20 microloans secured from out-of-state financial institutions through SBA Community Express Program with more than 24 sources of revenues or employment saved/created.

**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.

**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 marital conflict between parents. This exposure can negatively affect childrens' functioning, but not all children show detrimental effects. Two physiological processes, childrens' sleep quality and vagal tone (the ability of the parasympathetic system to reduce arousal) were identified as two explanatory mechanisms linking marital conflict and child well-being. Children in high conflict homes, whose sleep is disrupted, fare worse than do children who are able to sleep well, despite the conflict. Children who are able to sooth their arousal, despite conflict, are able to sleep better and fare better. These data will lead to new interventions for children suffering from the effects of marital conflict.

## 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 and February, 2005, 6 stakeholder sessions were held at the Auburn University Research and Extension Centers across the state. Attendees included over 320 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).

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 System 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, $1,614,060; Goal 2, $93,432; Goal 3, $213,141; Goal 4, $764,971; and Goal 5, $227,739.

## V. Integrated Research and Extension Activities

The following forms are included to document integrated research and extension activities: Form CSREES-REPT and FY 2005 Integrated Research and Extension Activities Project Summaries.

PROJECT SUMMARIES, FY2005

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 dominant market, including the increasingly popular *Echinacea* sp. (coneflowers) and a number of flowering shrubs. Several herbicides are found to be effective, but minor phytotoxicity was observed on some crops, particularly flowering herbaceous plants such as gomphrena. These studies are demonstrating effective herbicide choices in nursery production.

Title: **Accelerated Flowering, Chilling Requirements, and Growth Regulation of Herbaceous Perennials**
Studies are on-going on the effects of growth retardants on various perennials. These studies will help minimize handling of plants while appropriately managing plant size for optimum marketing.

Title: **Alternative Tillage and Soil Fertility Management Practices on Peanut Seed Quality and Yields.**
Peanut yields were consistently higher following cropping of bahiagrass compared to a conventional rotation of cotton-peanut. Improved soil conditions, primarily increased infiltration, coupled with a reduction in diseases contributed to the higher yields. Integrating cattle into cropping systems that include bahiagrass further increases economic returns, reduces risk and additionally justifies perennial grass culture for growers. These results are being shared with growers at regular grower meetings.

Title: **Animal Manure and Waste Utilization, Treatment and Nuisance Avoidance for a Sustainable Agriculture.** Studies on use of pelletized broiler litter as a source of nitrogen and phosphorus for plants indicate that litter pellets can be used as fertilizer. However, N and P contained in the broiler litter pellets may not be as available as that in inorganic fertilizer. These studies demonstrate alternative uses for poultry waste which will be a benefit to the poultry producers in the state.

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**
In addition to continued evaluations of improved pecan cultivars, studies are also looking at ways to moderate alternate bearing patterns. Results show that a combination of practices of late season fertility (August and September applications), insect control and canopy management may substantially increase the return crop. All pecan growers would prefer more consistent yields from year to year.

Title: **Decision-Making Under Uncertainty and the Economics of Risk in Alabama Agriculture.**
Studies on consumer preferences for satsuma have evaluated the trade-offs between retail price and sweetness, packaging, shelf life, and vitamin C content. Peeled-and-sectioned satsuma showed great market potential because of their convenience for use. These studies demonstrate options for marketing for satsuma producers.

Title: **Epidemiology of Plant Diseases in Crop and Urban Landscape Ecosystems**
On-going work on management practices that optimize the aesthetics of landscape plants by minimizing disease problems indicate that cultivar choice is important. Dogwood cultivars are being evaluated for their susceptibility to several diseases. In addition, fertility effects on dogwood diseases has been evaluated and found not to have a consistent effect either in allowing more disease or less. These results are important to nurseries where dogwoods are produced and to consumers who are increasingly knowledgeable about the quality of plant materials in the landscape.

Title: **Impacts of Trade and Domestic Policies on the Competitiveness and Performance of Southern Agriculture.**

Results of studies for this project indicate that cotton production in the Southeast U.S. has a competitive advantage compared to other production areas. This advantage is enhanced by the adoption of biotech-cotton. The effect of exchange rates on US agriculture was analyzed and information generated shared with policy makers. Exchange rate effects and risks depended on trade direction and the U.S. global market share. The information produced from these studies is used by U.S. traders and policy makers in their decision-making.

Title: **Integrated Sustainable Production Practices for Cotton (*Gossypium hirsutum*)**

Research was conducted in 2005 in Alabama on herbicide tolerant cotton varieties (Roundup Ready Flex, Liberty Link, and stacked genetics) with regard to on-farm performance, population dynamics, weed management systems, growth regulation, defoliation (on-going regional cotton belt project), conservation tillage systems, reniform nematode management, glyphosate-resistant weed management, and other production practices. Of particular interest was the work on losses in cotton as the proportions of herbicide resistant weeds increase. In addition to loss of yield quantity, fiber quality can decrease with increased weed competition.

Title: **Management of Arthropod Pests on Peanuts**

The demonstrations that are part of this study show that while both aldicarb and phorate treatment of peanuts reduce the incidence of leafhoppers, cultivar choice may have more of an impact on occurrence of the disease, tomato spotted wilt. Lowest insect numbers were observed with both an at-plant plus foliage applied insecticides regardless of cultivar planted. However, three newly commercialized cultivars had consistently lower disease levels than older cultivars.

Title: **Management of insect pests of forage and grain crops in Alabama**

After several years of drought conditions, the past several growing seasons (2002-2005) have had near normal rainfall, with populations of the forage insect, the masked chafer, gradually increasing during this time. Green June beetle grubs and earthworm populations were found to be elevated in areas where broiler litter was applied. This might be problematic because the green June beetle grubs have also been found to shift pasture grass composition to the less valuable common bermudagrass.

Title: S**ystems 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. Results are being shared with poultry producers through regular county meetings and have been favorably received due to potential for reduction in operating costs and improved flock performance.

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 the 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. This knowledge can contribute to managing the expansion range of this insect and provides information to citizens relative to minimizing the risk of introducing this pest into new areas. Related work is providing information on how ant colonies communicate and may lead to novel means of control.

Title: **The Ecology of the Mobile-Tensaw Delta: An Ecotone between Marine and Freshwater Ecosystems**

Large-mouth bass is an ecologically and economically important fish in Alabama waterways. In the Mobile-Tensaw Delta regions, water salinity and other factors can differ dramatically and affect fish populations. One result of this on-going study is the knowledge that larger fish are produced downstream (i.e., nearer to where salinity peaks in mid or late summer) and smaller fish are produced upstream.

Title: **The Poultry Food System: A Farm to Table Model**

In studies on eggs, work has shown that strain of hen and its age can lead to significant differences in egg functionality (i.e., whipping ability), and that cool water washing could reduce pathogen growth. This information is important for managing diseases and optimizing efficiency and value of eggs for that industry.

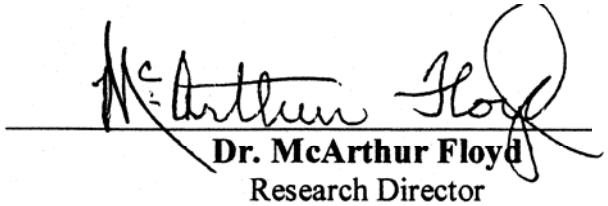
Title: **Water Quality Issues in Poultry Production and Processing**

This project sought to identify alternative materials and uses of bedding materials in chicken production. Sand was found to be acceptable as a bedding material, and can be re-sold for use by landscapers. Also of import is that performance of broilers reared on sand is equal to those reared on conventional bedding materials, even after 20 plus flocks.

## VI. Multi-State Extension Activities

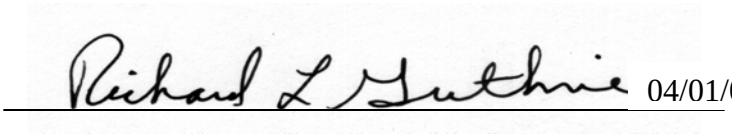
These activities are reported under the Five-Year Plan of Work from the Alabama Cooperative Extension System.

Certification of the *Annual Report of Accomplishments and Results for Alabama Agricultural Research Programs*, Federal Fiscal Year 2006:



04/01/06

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



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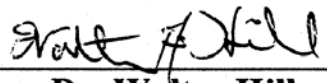
**Dr. Richard Guthrie**
**Dean and Director, College of Agriculture**
**and Alabama Agricultural Experiment Station**
**Auburn University**



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**Dr. Walter Hill**
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