ANNUAL REPORT OF ACCOMPLISHMENTS AND RESULTS

For

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
2000

October 1, 1999 – September 30, 2000

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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. However, our universities increasingly collaborate on research in areas where the needs of our clientele (producers, processors, agribusinesses, consumers, stakeholders, alumni, students, and others) merge. As administrators of 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. Effective partnerships are the springboard for efficient use of our resources, both human and fiscal, to meet the needs of our state clientele and the nation. 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 recently entered into a memorandum of understanding to form the Alabama Agricultural Land-Grant Alliance (AALGA) to better address critical issues in food, agricultural and natural resources in the state, region and nation through multidisciplinary, multi-institutional, science-based teams that focus on opportunities and challenges facing farmers, consumers and agribusinesses. The AALGA also seeks to provide quality education that prepares professionals for career opportunities in food, agriculture and natural resources.

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 efforts of International Program Offices on each campus to promote international market development and other international initiatives that strengthen the U.S. economic competitiveness and provide professional and cross-cultural experiential learning opportunities for students, staff, and faculty.

This Annual Report of Accomplishments and Results is a reflection of research activities for the 2000 fiscal year as reported in the Plan of Work required by AREERA (Agricultural Research, Extension and Education Reform Act) of 1998.

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

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

POINT of CONTACT: This plan is jointly submitted by: *Dr. Luther Waters* (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 McArthur Floyd, who is providing leadership in this effort.

Dr. Luther Waters
Dean and Director
College of Agriculture, and
Alabama Agricultural Experiment Station
Comer Hall, Room 107
Auburn University, AL 36849-5401
Phone: 334/844-2237 FAX: 334/844-2937

Dr. Walter Hill
Dean and Research Director
College of Agricultural, Environmental and Natural Sciences
Campbell Hall, Room 100
Tuskegee, AL 36088
Phone: 334/727-8157 FAX: 334/727-8493

Dr. McArthur Floyd
Research Director
School of Agricultural and Environmental Sciences
James I. Dawson Building, Room 300B
Post Office Box 1087
Normal, AL 35762
Phone: 256/851-5781 FAX: 256/851-5906

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

PLANNED PROGRAM

Following is the Annual Report of Accomplishment and Results 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 globalized economy is a major contributor to the national economic growth and well-being of the American people. Markets for Alabama's farm and forest products are international in scope, are dynamic, and require careful study if Alabamians are to benefit from changes in trade policies, immigration laws, labor relations, human capital, transportation, communications technology, consumer preferences, and other forces shaping the national and international markets for Alabama's food, fiber, ornamental horticulture, and forest products. 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 the development of 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 initiated research on 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, profitability of small farms, alternative animal feed from agricultural by-products, new sweetpotato varieties, gene mapping of chickens and other poultry species; and development of transgenic sweetpotato plants with a high protein content.

At Auburn University, scientists have initiated research in multiple areas of plant and animal research. These programs have resulted in new and improved crops and cropping methodology in agronomic and horticultural crops, improved detection and differentiation of viral poultry diseases, and the use of estrogen-progesterone growth implants to improve an animal's response to disease. Other research in fisheries and aquaculture has resulted in improving protein content of feed to increase catfish growth, improving marine shrimp production in Alabama, and the creation of artificial reefs and nursery habitats for red snapper production. Other research activities have reduced insecticide use in Alabama by increasing the efficiency of predaceous insects as biological control agents and thus reducing pesticide runoff.

At Alabama A&M University, research efforts 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, and the developments of alternative specialty crops.
The accomplishments thus far are encouraging and are on target with stated objectives. The success of these programs will ultimately result in new markets for sweetpotato and peanut

products, development of pest resistant and high nutrient content sweetpotato and peanut germplasm, production efficiency for small ruminants and rapid genetic analyses and characterization of poultry genome. The results will also assist in the development of small farm technology to keep underserved limited resource farmers in profitable farming business. The results also provide new and innovative methods for improved crops and their use as alternative foods, improved animal and poultry health and production, and new profitability in aquaculture.

Additionally, 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.

Inst.	FY 2000		FY 2001		FY 2002		FY 2003		FY 2004	
	Approximate Expenditures ($)	SY	Projected Expenditures ($)	SY	Projected Expenditures	SY	Projected Expenditures ($)	SY	Projected Expenditures ($)	SY
1862 (AL)	15,411,148	56	15,717,357	42	16,503,225	42	17,328,386	42	18,194,806	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	905,083	6	950,337	6
Totals	17,433,398	69	17,947,290	56	18,844,653	56	19,786,885	56	20,776,229	56

Allocated Resources ($) and Scientists Years (SY).

Key Theme: Value-added Foods

a. **Statement**: At Tuskegee University several food products including pasta, drinks, ice cream and assorted confectionaries were developed using sweetpotato and peanuts as the base. These products were found to be high in nutrient content and sensory evaluations have been conducted. Analyses of the sensory data showed high acceptability of most of the products developed.

α. **Impact**: More that 80% of the two hundred individuals that participated in the sensory evaluation indicated that they would buy or incorporate some of these new products into their meals.

β. **Source of Federal Funds**: Evans-Allen

χ. **Scope of Impact**: State Specific

Key Theme: Economics

a. **Statement**: A linear programming model for optimizing log allocation in a southern pine lumber-chip production system was developed and validated through a case study involving an integrated wood-processing mill in Alabama. The production system involves dimension lumber manufacturing with a bandmill and a chip-n-saw (CNS) as log breakdown equipment and whole log chipping. Also, a multistage optimization model for maximizing the profitability of an integrated wood products manufacturing operation was developed. The model was validated through a case study involving an integrated hardwood lumber and cabinet assembly operation in Alabama. Modeling work aimed at determining the economic desirability and impact of log merchandising in tree-length chipping operations is currently being pursued.

α. **Impact:** The linear programming-based lumber-chip production model mentioned above is helpful to the management of such systems in optimally allocating log input resources. The multistage optimization model mentioned above can be very helpful to the management of such integrated systems in managing and controlling production and inventory (including in-process inventory). Also, the model proved to be very useful in analyzing log procurement issues, such as determining the most profitable species, sizes, and grade of logs that should be procured and what could be offered as maximum price premium incentives to ensure the delivery of these logs and still achieve a target return on investment. Through parametric analysis, it was also determined that system profitability is most sensitive to sawmilling cost, kiln-dried lumber prices, and log input prices. Furthermore, it was determined that small improvements in lumber recovery and drying degrade percentage would result in large increases in net revenue for the current mill setup.

β. **Source of Federal Funds:** McIntyre-Stennis

χ. **Scope of Impact:** State Specific

a. **Statement:** Using software developed at Auburn University, scientists have been collecting data on the World Wide Web and constructing a visual database to explore the role played by the perceived "fit" between a product and a valued lifestyle in shaping the wants and needs of 20-something female customers for textile and apparel products. The conceptual framework of this project emphasizes the role of consumer aspirations in shaping behavior, as well as the crucial role played by the media in shaping the lifestyle connotations of specific products. And, while most research on apparel choices tends to be confined to a specific product category, the Auburn model instead emphasizes how textile and apparel products are evaluated in the context of other products with which they are jointly consumed to make a lifestyle statement. By emphasizing how consumers' aspirations are expressed visually, as they evaluate and select products, researchers can forge tools that will help the clothing/textile industry better understand the specific lifestyle images sought by its customers.

α. **Impact:** The methodology of this research is the only visually based browser interface designed to evaluate consumers' preferences for apparel items. Numerous companies and trade associations have expressed strong interest in this system, and a feasibility study to apply this methodology to apparel product testing is being funded by Vanity Fair. Implementation of the system will allow textile firms in the Southeast to routinely gather competitive intelligence in a far more cost-efficient manner, and better anticipate the emerging needs and preferences of consumers around the world.

β. **Source of Federal Funds:** Hatch

χ. **Scope of Impact:** State, National

Key Theme: Improved Crop Systems

a. **Statement:** The sweetpotato is a nutritionally and economically very important crop in the state of Alabama and southeastern United States. In an effort to improve the quality and the production efficiency of sweet potatoes, scientists at Tuskegee University are using biotechnological approaches including genetic engineering and tissue culture techniques to develop new varieties that are disease resistant and possess high nutrient content.

α. **Impact:** A CAMV35S driven – 292 bp synthetic gene (asp-1), coding for a storage protein with essential amino acids, was introduced into sweetpotato using Agrobacterium tumefaciens to improve the nutritive value of sweetpotato protein. Genetically engineered plants exhibited a 2 to 5 fold increase in the total protein amount in leaves and storage roots compared to the control. Freshly harvested storage roots of one transgenic line had 11.3% protein on a dry weight basis, representing nearly 500% increase over the control (2.2% protein). A significant increase in the level of essential amino acids such as methionine, threonine, tryptophan, isoleucien, and lysine was also observed. Based on protein gel electrophoresis, the high protein content appears to be due to the increase level of native proteins such as sporamin, the dominant protein in sweetpotato storage roots. In a field test, transgenic lines grew normally, and two lines with the highest protein did not significantly differ in their yield compared to the control. Genetically modified sweetpotato for fungal resistance was developed and field-tested. In addition, transgenic sweet potatoes developed with coat protein gene for resistant genes have been introduced into the two widely grown sweetpotato cultivars (Beauregard and Jewel). In other studies, a three-year successive yield stability test of several sweet potato breeding lines in three varied environs showed one high yielding line to be very stable. This variety is expected to perform well under favorable or adverse conditions.

β. **Sources of Funding**: Evans-Allen

χ. **Scope of Impact**: State Specific

a. **Statement:** In an effort to address the concerns of this growing industry in Alabama, a three-year study focusing on side-by-side comparisons of growth and development of pumpkin as affected by different cover crops, tillage systems, and different rates of N was initiated at the North Alabama Horticulture Substation in Cullman, Alabama. Three different cover crop systems are being evaluated: yuchi arrowleaf clover, hairy vetch, and wheat combined with crimson clover. Within each of these cover crops, three nitrogen rates (0, 45, and 90 pounds per acre) are being evaluated. Each cover crop was allowed to die back naturally. Covers were moved down before plots were strip tilled.

b. **Impact**: The researchers are starting the second year of this study. Last year, there was no difference among nitrogen rates between the treatments. There were differences, however, between cover crops. Yields were higher with any cover crop compared to the bare ground treatment. Marketable yields (lb/acre) were as follows: 25,726, vetch; 21,974, yuchi; 20,227, wheat/crimson; and 16,136, bare ground. These initial results indicate that there is a positive benefit to using mulch. Vetch-covered plots yielded significantly more that all of the other covers. Bare ground plots produced the lowest yield compared to any of the other treatments. This work will continue and more information will be available in the winter, 2001.

β. **Sources of Federal Funding:** Hatch

χ. **Scope of Impact:** State Specific

a. **Statement:** Colored plastic mulches have been shown to have different effects on vegetable crops. Auburn University scientists have been studying a wide range of colored plastics to see which colors provide the most benefits to a crop. Mulches in blue, brown, black, reflective, and clear plastic were applied to cultivated vegetable crop such as tomatoes, summer squash, okra, and melons. The color stimulates various reactions by the plants. Colored mulches have been shown to stimulate crop growth and deter insect pests. Clear plastic mulch can be used to solarize soil, which helps control soil-borne insects and disease pests. The project began in 1986 and will continue for another 10 years.

α. **Impact:** Results of this study have already identified uses for various mulches. Black plastic mulches result in a more than 100 percent increase in yield of field-grown Auburn University Producer watermelon and Clemson spineless okra. It produced similar results with Chilton cantaloupe. Reflective plastic mulch reduced and delayed viral disease incidence and severity in summer squash vectored by aphids. Reflective mulch also delayed and reduced viral disease in tomatoes. In both cases, viral disease was delayed two to three weeks, which helped extend each crop's production season, thus allowing more yields per crop. Clear plastic mulch was used to solarize soil during hot summer months. The study showed that, in Alabama, 60 to 90 days of incubation under clear plastic controlled many soil-borne bacteria and fungal diseases in vegetable crop production. Red plastic mulch produced variable yield in tomatoes.

β. **Source of Federal Funding:** Hatch

χ. **Scope of Impact:** State Specific

a. **Statement:** Researchers at Auburn University conduct vegetable variety field tests annual and publish twice a year a vegetable variety trial report that presents the latest findings. They also release more in-depth Extension publications with ratings of variety performance and recommendations. The most recent addition to the program is our new web site called "Auburn University Vegetable Varieties Online." It can be accessed at:
http://www.ag.auburn.edu/dept/hf/faculty/esimonne/.

a. **Impact:** The impact of the vegetable variety trial program has been very broad. First, commercial vegetable growers have largely adapted their variety selection following Auburn's results. Seed companies have increased on-farm testing in Alabama. Every year, three to five of the major seed companies attend a vegetable variety trial forum at the Alabama Fruit and Vegetable Growers Association meeting. Back-yard gardeners always enjoy information on "odd" and new vegetable types, such as white pumpkins, colored bell pepper, pink eggplants, and exotic melons.

α. **Source of Federal Funding:** Hatch

β. **Scope of Impact:** State Specific

a. **Statement:** One long-running Auburn University project has examined ways to minimize the risk of aflatoxin contamination in peanuts. Research on aflatoxins has been on going for about 10 years. Through this work, the relationship of the lesser cornstalk borer insect, to the risk of aflatoxin contamination has been defined. Specifically, the lesser cornstalk borer creates holes in peanuts through which the fungi that produce aflatoxins can enter. Both this insect and the fungi are favored during periods of hot, dry weather. Another project has looked at control of black spot disease on roses. Investigations on winter applications of different fungicides have been on going for four years.

α. **Impact:** Information gathered in the aflatoxin toxin study is helping producers predict when aflatoxin contamination of a peanut crop is likely to occur. In addition, results have shown farmers how to time insecticide applications for more efficient control of corn borers, which can be predicted based on hot, dry conditions. Results of the rose study have shown that applying certain fungicides early in the season will delay the onset of blackspot disease. Delaying the start of disease development allows growers to use fewer fungicide applications over the remainder of the growing season, which reduces costs and the potential for environmental pollution from the insecticides.

β. **Sources of Federal Funds:** Hatch

χ. **Scope of Impact:** State, Regional

a. **Statement:** Auburn University researchers are developing new forage cultivars to be used also in the protection and conservation of soil and water resources, reduction of surface water pollutant transport, improvement of soil productivity, preservation of a favorable balance between pests and predators, and to enhance biological diversity. In addition, some of the cultivars have ornamental value for banks and roadsides or for the production of bioenergy. Species bred are sericea lespedeza, vetches, crimson clover, red clover, white clover, spotted bur clover, and switchgrass. Several generations of plants are exposed to environmental and agronomic challenges. Superior plants are selected on the basis of survival, productivity, health, agronomic characteristics and market demands. It takes eight to 15 years per species to complete the project.

α. **Impact:** Recent cultivar releases from this work include: Auburn University Merit, released in 1999, is a hairy vetch cultivar that, on the average, has a forage yield 4-12% higher than common hairy vetch and flowers 7-13 days earlier than the common type. Auburn University Grazer, released in 1997, is the first sericea lespedeza cultivar tolerant to grazing. This cultivar has higher survival and more vigor under grazing conditions than other sericea lespedeza cultivars. Also, it has better forage quality as is evidenced by the lower lignin content and more digestible dry matter than previous cultivars. Auburn University Sunrise, released in 1997, is the earliest maturing crimson clover cultivar in the market. It was selected and released in cooperation with Mr. Charles M. Owsley and Mr. Malcolm Kirkland, USDA-Natural Resources Conservation Service.

β. **Source of Federal Funds:** Hatch

χ. **Scope of Impact:** State, Regional

a. **Statement**: Research is focusing on how each of the two ornamental traits (song and plumage) is affected by two types of pathogens, coccidia and Mycoplasma gallispticum. Coccidia are a chronic intestinal disorder that is known to inhibit carotenoid uptake in birds. Mycoplasma gallispticum, in contrast, is a bacterial infection of the eye and upper respiratory system with rapid onset. Auburn University scientists are focusing on these pathogens and, in a combination of field observations and laboratory infection and mate-choice experiments, they will test the idea that some ornamental qualities signal long-term health, while others are related to immediate health.

b. **Impact:** This study will provide important insight into how selective forces shape the evolution of animals and it will also provide new data on the co-evolution of parasites and their hosts. While the purpose of this research is not explicitly to increase food production, the topic of this research has important implications for the poultry and other animal product industries.

a. **Source of Federal Funding:** Hatch

α. **Scope of Impact**: State, National

a. **Statement:** An Auburn University project is designed to address soybean production issues using classical breeding methods of plant improvement to improve soybean yields. The project began in 1981 and is ongoing. Research shows plenty of genetic variability left in adapted soybean germplasm. Auburn also is working with velvetbean as an alternative crop.

α. **Impact:** Auburn released a new soybean cultivar ('Kuell') in 1999. This variety has outstanding performance in late-planted environments (which constitute a major portion of soybean production in south Alabama), yielding 6.7% higher than the cultivar Cook. Other cultivars are being developed, including those with and without herbicide resistance, such as Roundup-Ready cultivars. Earlier experiments with velvetbean as a rotation crop showed that soybean yields were improved by 100% following velvetbean compared to continuous soybean. The Auburn University researchers are now evaluating velvetbean's potential as a cover, grain, or forage crop.

β. **Source of Federal Funds:** Hatch

χ. **Scope of Impact:** State Specific

a. **Statement:** Research has been conducted since 1992 evaluating Roundup Ready (RR) cotton in both conventional and conservation tillage systems. Studies were initiated in 1998 to evaluate RR cotton in ultra-narrow-row (UNR) cotton production systems.

α. **Impact:** Auburn's results show that RR cottonweed management systems provide excellent overall weed control and enable growers to manage weedy fields without herbicide injury to the crop in most cases. RR cotton technology has significantly decreased the weed control level needed to produce UNR cotton.

β. **Source of Federal Funds:** Hatch

χ. **Scope of Impact:** State Specific

a. **Statement:** Research has proven that soyfoods and soybean components attribute significantly to good health and serve as cancer fighters. In the southern region, soybean growth can be limited by the presence of aluminum or other metal toxicities associated with soil acidity. Current work is taking place in the laboratories of Alabama A&M University to look more closely at the genetics of this valuable food in order to increase its production and quality. Alabama A&M University scientists are investigating the linkage relationships among molecular markers generated with gene specific and non-specific primers found in soybean [Glycine max L. (merr)]. The results indicated that, at least half of the primers used generated polymorphic fragments, which segregated in a Mendelian fashion. A total of 43 polymorphic marker loci were identified; 30 marker loci were linked and distributed among 5 linkage groups and 13 marker loci were unlinked. Arbitrary primers revealed more polymorphisms than specific primers. A two-primer combination of OPA 5 and OPA 18 revealed the maximum number of polymorphic bands. Several key biochemical pathways have been implicated in aluminum tolerance mechanisms in soybean as a direct result of these findings, including signal transduction pathways, cell membrane and cytosolic constitution alteration pathways; pathogenic and environmental stress related pathways, and receptor-mediated pathways, 41 cDNA were sequenced, 19 of which were found to correspond to mRNAs induced by Al. Six of the 19 clones, all derived by screening with

the Bedford probe, showing strong homology (83-90%) identify to RNA2 of the comovirus Bean pod mottle virus (BPMV). The largest of these clones, 6-5, corresponds to BPMV RNA2 coordinates 1105-3556, with a 43 nt deletion starting at coordinate 1793. Presumably, the BPMV-related cDNA clones were either from soybean RNA or from BPMV RNA accumulated during unnoticed BPMV infection of the soybean tissue. Further studies are continuing to understand how the viral sequence was integrated into the soybean genome.

b. **Impact:** Plant breeders are now able to select the high yielding soybean cultivars, thus increasing farmers' income and maintaining low cost soybean products, due to increased availability - creating benefits for the farmers and consumers.

c. **Source of Federal Funds:** Evans-Allen

d. **Scope of Impact:** State Specific

a. **Statement:** Cotton, a major cash crop for Alabama, has become a financial loss for some farmers due to the low prices and high cost of inputs for production. Planting cotton in narrow rows and the use of transgenics to decrease the costs of insect and weed control are techniques to boost yield and cut the cost of production. Transgenic (Roundup-Ready/Bt) cotton cultivars were used to compare the effect of Roundup applied at 4, 6 and 8 weeks after planting. The cultivars were planted in conventional (40-inch) and ultra narrow (7.5-inch) row spacings. Data on plant population, number of open-bolls and seed cotton yield were collected and analyzed to determine potential differences between the two systems of production. Application of Roundup after 4 and 6 weeks had no significant effect on seed cotton yield and number of open bolls. Significant difference in plant population was obtained as a response to row spacing. Plants in conventional row spacing produced more open-bolls (an average of 5) compared to less than 2 for ultra narrow row cotton. The increased number of plants per square meter in the ultra narrow row system compensated for the low number of bolls per plant. Data from the 2000-growing season indicated a significant decrease in seed-cotton yield as the application date of Roundup was delayed past the sixth-week after planting. A field day in cooperation with area cotton growers was organized and held.

α. **Impact:** Results from this research will establish recommendations for time of Roundup application in no-till/conventional planted transgenic cotton in 40-inch and 7.5-inch row spacings. Through field days and growers' collaboration with on-farm research, farmers are able to provide their inputs toward the overall improvement of cotton.

β. **Source of Federal Funds:** Evans-Allen and State Agricultural Experiment Station

χ. **Source of Impact:** State Specific

a. **Statement:** The vast majority of the world's livestock industries depend on forage-crop farming as their mainstay. Forage crops can be mowed, dried, and stored as hay; chopped and stored wet as silage/fodder; or fed directly to cattle as pasture or freshly chopped forage. Researchers at Alabama A&M University planted Eastern gamagrass on five acres of land to look at the nutritive benefit of various grasses. However, an unusual drought along with an unexpected frost negatively impacted the outcome. Tifton 44 Bermudagrass pasture intended for the experiment was also badly hit by the frost. These forages will be available in 2001 and the sheep and cattle grazing trials will be conducted on the two pastures. Six triticale cultivars (TCL-111, TX-98D955, TX-96VT5019, TCL-2700, TCL-498 and TCL-105), two cultivars of wheat (Jackson and Roberts), rye (Maton and Oklon), tall fescue (Worrior and Oregon), and one orchardgrass (Potomac) intended for forage evaluation in Experiment 2 were planted in

4-row plots 5 m long with rows 25 cm apart. Forages will be ready for first cut sample collection and chemical analysis later.

b. **Impact:** The research will generate important information regarding the nutritive value, meat production potential, and forage quality and productivity of triticale and other annual small grain crops and eastern gamagrass. Further, the results will have immediate application by livestock producers as a means of extending the grazing season thereby making year-round grazing possible and improving animal performance and the return from livestock operations.

c. **Source of Federal Funds:** Evans-Allen

d. **Scope of Impact:** State Specific

Key Theme: Improved Poultry Systems

a. **Statement:** Scientists at Tuskegee University have developed a procedure for rapid synthesis of expressed sequence tag sites (EST), in poultry. Using this procedure, a total of 125 EST for chicken and turkey genomes have been synthesized and characterized. The ESTs have also been used for comparative sequence analysis with other poultry species including pigeon, quail and guinea fowl.

α. **Impact:** To date, the comparative genome analysis of the poultry is facilitating the identification of economically important genes in several poultry species. The ESTs also provide a rapid and less costly approach to gene discovery and the development of genomic maps for little understood poultry species including turkey, guinea fowl, quail and pigeon.

β. **Sources of Federal Funds:** Evans-Allen

χ. **Scope of Impact:** State Specific

a. **Statement:** Researchers have developed monoclonal antibodies, recombinant probes, the polymerase chain reaction (PCR) test, and sequencing of nucleic acids that are helping control disease and increase production in Alabama's poultry operation. Researchers used these reagents and procedures to develop immunoperoxidase assays, in situ hybridization assays, PCR restriction fragment length polymorphism tests, and in situ PCR hybridization tests. These tests have been given to the Alabama State Veterinary Diagnostic Laboratory to help them diagnose diseases of commercial poultry flocks.

α. **Impact:** These tests allow for the improved detection and differentiation of viral diseases of poultry, which ultimately lead to improved prevention and control of these economically important diseases. This will reduce production costs resulting from lowered growth rate, feed efficacy, mortality, and processing plant condemnations associated with these diseases.

β. **Source of Federal Funds:** Hatch

χ. **Scope of Impact:** State Specific

a. **Statement:** Auburn University scientists are developing a vaccine against reovirus. The project, which began in 2000, is taking a current available live vaccine against reovirus (from Schering-Plough) and reducing its ability to cause disease in embryos by reducing the per-egg dose of vaccine and mixing antibody against reovirus with the vaccine. Combining the antibody complexes with the live vaccine virus delays, the replication of the vaccine until after the chicken has hatched. This immune complex vaccine does not cause disease in chickens, and when the researchers challenged chicks at three weeks

after vaccination, this In Ovo vaccinated chickens were resistance to an arthritic form of reovirus. Future studies will focus on finding the right combination of vaccine and antibody to use that will be safe, efficacious, and economically feasible to use under commercial conditions. They also are determining if the vaccine will immunize chickens against the enteric form of reovirus. Embrex, Inc. has a patent on a similar vaccine antibody complex for use In Ovo against infectious bursal disease virus in chickens. They are cooperating with Auburn in a joint venture.

α. **Impact:** The studies have shown that there is a potential for an In Ovo administration vaccine against reoviruses for chickens. The Auburn team is the only group in the nation exploring this area of study. Improved control of reoviruses in chickens will save poultry producers and ultimately poultry consumers' money.

β. **Source of Federal Funds:** Hatch

χ. **Scope of Impact:** National

Key Theme: Improved Animal Systems

a. **Statement:** Goat production is becoming a fast growing industry in Alabama. This has thus raised the need for efficient production methods. Cottonseed, a by-product of a major crop in Alabama and the southeast is an inexpensive source of protein and energy that can be incorporated in animal feed for goats. Research at Tuskegee University is determining the effect of feeding whole cottonseed on growth, blood parameters and reproductive performance of goats.

b. **Impact:** Research results thus far have shown that incorporating whole cottonseeds up to 15% in the diets of goats increased feed use efficiency and can reduce production costs up to 25%. This percent amount of cottonseed in the diets of goats has no adverse effect on the reproductive performance of the male goats.

c. **Sources of Federal Funds**: Evans-Allen

d. **Scope of Impact**: State Specific

a. **Statement:** Two major efforts are underway at Auburn University to help control livestock disease. One effort is looking at the possibility that estrogen-progesterone growth implants may improve an animal's response to disease-coccidiosis or bacterial endotoxemia have been examined. The other aspect is disease control of growth and reproduction, and scientists are looking for the mechanism for diseases to alter growth hormone and luteinizing hormone secretion.

α. **Impact:** Previous research suggests that a simple and available anabolic agent can minimize the impact of many disease effects on an animal. Also, infected calves lose weight while calves given estrogen-progesterone increase body weight in spite of the infection. The net effect is that the producer does not lose as much productivity.

β. **Source of Federal Funds:** Hatch

χ. **Scope of Impact:** State, National

a. **Statement:** Over the past decade, Auburn researchers have isolated and purified a number of biologically active molecules from the salivary glands of two blood-feeding insects. They believe that some of these factors, as well as other salivary molecules that await discovery, could be used in a modern pharmacopoeia for treatment of

cardiovascular disease, diabetes, and possibly certain types of cancers. They have been working the past decade on insect salivary factors and hope to have a horn fly vaccine tested within the next year. One potential drug candidate has been tested for the past year and the results are quite promising.

α. **Impact:** Results to date indicate that a horn fly vaccine is feasible based on the number of salivary molecules that could be vaccine targets. As a result, the researchers have received funding from both the USDA and industry to pursue this goal. The use of vasoactive/anticoagulant factors as drugs is just beginning and two major drug companies have expressed interest in this possibility. The horn fly research is unique in the nation and internationally. The "drugs from bugs" research is unique regionally. The economic impact of a successful horn fly vaccine could be enormous (hundreds of millions of dollars per year). The economic benefits of new drugs are difficult to calculate but one could predict that the quality of life will be improved not only for persons in this region but globally.

β. **Source of Funding:** Hatch

χ. **Scope of Impact:** State, National, Global

a. **Statement:** Scientists at Alabama A&M University characterized the normal pattern of the amylase and acid phosphatase enzymes in the serum of normal fertile rabbits during estrus, post-ovulation (24 and 72 hours after hCG) and pseudopregnancy (7 and 14 days after hCG). Females exhibiting no signs of estrus and male rabbits were also evaluated and compared. The findings revealed that amylase activity in the peripheral blood of fertile females during varying phases of their reproductive cycle ranged from 70.05 u/l to 134.55 u/l. The results further revealed that serum acid phosphatase activity in fertile rabbits regardless of gender, ranged from 5.25 u/l to 11.67 u/l. In general, however, mean serum amylase levels in males were slightly lower and inversely, mean acid phosphatase levels were slightly higher when compared to females.

b. **Impact**: Because of the short gestation period of rabbits, it was used to study the relationship between enzymes and fertility. This enzyme study revealed that the rabbit might be a critical link to answering pertinent questions regarding the emotionally devastating reality for the occurrence of infertility in women. It seems that the levels of the two enzymes B amylase and acid phosphatase play a significant role in this correlation. From these results, scientists will be able to develop tests for pregnancy diagnosis, fetal monitoring and/or infertility. Efficient reproduction is the fundamental basis for animal production and profitability.

a. **Source of Federal Funds:** Evans-Allen

b. **Scope of Impact:** State Specific

Key Theme: Integrated Pest Management

a. **Statement:** An Auburn University laboratory group is investigating ways of increasing the efficiency of predaceous insects as biological control agents. They use behavioral experiments to identify the most efficient predators of key insect pests and are attempting to manipulate the agroecosystem to maximize the abundance and efficiency of these predaceous insects. One project is determining if fire ants are attacking predaceous insects, such as ladybugs, and interfering with the natural control of insect pests, such as aphids, and investigating ways of reducing the numbers of fire ants in agricultural fields.

This research started in the spring of 1999 and will continue for at least the next three years.

α. **Impact:** By cutting insecticide use in Alabama, farmers can decrease the amount of noxious chemicals that leech into soils and ground water and help make Alabama's environment safer for humans and wildlife. One of the primary research goals of this Auburn program is to increase the efficiency of biological control, the use of predators and parasites to control insect pests, as an alternative to intensive use of costly and noxious insecticides.

β. **Source of Federal Funds:** Hatch

χ. **Scope of Impact:** State Specific

Key Theme: Development of Alternative Specialty Crops

a. **Statement:** Auburn University researchers are investigating greenhouse production procedures that force coreopsis, shasta daisy and yarrow. Techniques they are using include vernalization, photoperiod manipulation, and plant growth retardant application. Currently they are working on methods to increase offset production for rapid propagation of several perennials.

α. **Impact:** Results of this work provide new alternative flowering crops for the greenhouse and nursery industries in Alabama. Several wholesale growers in Alabama have started producing perennials over the past three to four years and sales have been strong.

β. **Source of Federal Funds:** Hatch

χ. **Scope of Impact:** State Specific

a. **Statement:** Shiitake mushroom production is a viable and potentially lucrative farming enterprise. Efforts are always on going to find ways to make their outcome more substantial. Research at Alabama A&M University was conducted by adding sugar to the soak water to determine if it would positively affect the yield. The soak water was studied at three rates (0, 20, 40 g/L) and three sequences (1^{st} soak only, 2^{nd} soak only, and each soak) the highest yields were obtained from the control blocks (no sugar) and strain '26.' Increasing levels of sugar in the soak water decreased overall production. The timing of the sugar addition had no effect on yields. When Nitrogen (urea) was added at the rate of 0, 2.4 and 3.6 g/L over 3 sequences (as above), it produced the highest yields (449 g/block) at the rate of 0.4 g/L; when added to each soak. The 3.6 g/L rate produced almost as much (411 g/block) when added only at the second soak. The results showed that sugar should not be considered as an additive to the soak water. However, the addition of urea to the soak water is an economically feasible option. Sawdust block strain '26' is superior to the other strains evaluated. There was a "log-grown" mushroom version of this experiment. Logs were soaked the 2^{nd}, 4^{th}, or continuously soaked in 0, 20 or 40 g/L sugar or 0, 1 or 2 g/L urea. These logs began fruiting in the winter months. The entire collection of data from this endeavor will be completed during the current year.

α. **Impact:** Shiitake, second only to the button mushroom, is the world's most cultivated mushroom. Most often, it is grown outdoors on logs, but can also be grown indoors on sawdust. Generally selling for $8 to $12 per pound, producers that utilize urea in their soak water can realize an increase of 80 to 90% in production of shiitake mushrooms from sawdust blocks.

β. **Source of Federal Funds:** Evans-Allen and State Agricultural Experiment Station

χ. **Scope of Impact:** State Specific

a. **Statement:** Fireblight is a very infectious and destructive disease attacking more than 75 different species of plants (Rosaceae family), which include the apple, crabapple, pear, and plum. Because a severe outbreak can destroy a tree in one year, it is critical to develop new breeds of plants that are less susceptible to this disease, as well as to find ways of controlling its occurrence. Approximately two years ago, there was a severe incidence of fireblight in the northeast region of Alabama. Initially the strikes in the period just following bloom were minor and were pruned out; however, the number of strikes and the severity of subsequent infection both increased during the mid-summer growing season and corresponded to a period of high rainfall and humidity. The cultivars most severely affected were Chojuro, Twentieth Century, Shinseiki, Okusankichi, and Hosui. The cultivars least affected were Shinko, Korean Giant and Ichibanashi. The entire planting suffered substantial losses and tree mortality for the year was 25%. Clearly, choice of cultivar plays an extremely important role in determining successful nashi production in the northeast region of Alabama. Scientists at Alabama A&M University evaluated three alternative crops (Asian pear, Actinidia spp., and Ziziphus jujuba) for their adaptability to northern Alabama conditions including 1) field performance and fireblight susceptibility of 10 different Asian pear cultivars on 4 rootstocks, 2) the relative midwinter cold hardiness and fruiting characteristics of 6 species of Actinidia and 3) the winter survival and fruiting characteristics of jujube.

b. **Impact:** If successfully grown, they will provide diversity of fruits for Alabama home growers, orchardists, along with variety for the southeastern diet, thus increasing the economic base of Alabama fruit growers.

c. **Source of Federal Funds:** Evans-Allen

d. **Scope of Impact:** State Specific

a. **Statement:** Most canola studies in the southeast develop production practices using existing lines or varieties developed for other environments. The wide range of products derived from canola and its relatives provides a great opportunity to genetically tailor new varieties for industrial and nutritional application. New germplasm varieties can be developed for such products as soap, detergent, oleochemical, margarine and other uses. Presently many such products are produced from coconut and palm kernel oils, which are imported into the United States. An in-depth investigation is in progress at Alabama A&M University to further explore the potential of canola as a major profitable crop in this state and other mid-south states with a focus on the Tennessee Valley region. This involves a comprehensive breeding program using both classical and molecular approaches. The researchers collected, screened and maintained a diverse germplasm of Brassica species; used marker-assisted selection (MAS) to identify resistance to blackleg disease, insect resistance and other agronomic traits; and evaluated new elite lines resulting from interspecific and intergeneric crosses for agronomic and commercial values. Selection will increase seed yield, winter hardiness, disease and insect resistance, lodging and shattering resistance, quality of seed and oil and quality of the seed meal.

α. **Impact:** In the mid-south region, wheat is currently the only main winter crop; however, canola's cold tolerance makes it a valuable rotational crop, allowing for disease control in wheat (take-all disease). Therefore, introducing canola in the traditional wheat/soybean rotation will have a positive impact for growers on cultural management practices and the environment also potentially creating additional processing industries.

β. **Source of Federal Funds:** Evans-Allen
χ. **Scope of Impact:** State Specific with AL, KS

Key Theme: Fisheries and Aquaculture

a. **Statement:** For the past five years, Auburn scientists have been examining the detailed structure of the striped bass sperm and in particular, the sperm tail, which propels the sperm toward an egg. To date they have completed an ultrastructural study of the sperm, which enables them to understand the proper organization of this cell in this species. In addition, they are completing studies of the protein biochemistry of the enzyme proteins that make up the sperm tail. Emphasis is on the structural relationships between the proteins of the sperm tail; i.e., they are trying to figure out how the sperm tail is constructed. This structural analysis is being carried out at the molecular level.
α. **Impact:** Analysis of the sperm tail protein molecules provides insight into the optimal conditions for maintaining the best conditions for fertilization. The researchers have developed new procedures that will be useful in all types of fish research and have also learned that the striped bass is very similar to several other species of related ("Perciform") fish, so information gleaned from work on striped bass is very likely to be applicable to other species. These research results can also be used to study fertility issues in livestock and humans. This is a very important issue, since recent studies in other laboratories have suggested that all male organisms seem to be undergoing a decrease in their fertility due to impact from environmental pollutants. Auburn's research on this subject is the only work underway on this species. Though it is difficult to define the precise dollar value of this type of basic cell biological/biochemical/physiological research effort, it has great potential to impact hatchery efficacy, tourism dollars, and agricultural and human reproductive health.
β. **Source of Federal Funds:** Hatch
χ. **Scope of Impact:** State Specific

a. **Statement:** Auburn University pond studies have been conducted to look at the effect of protein content on feed and feeding rate on growth and feed conversion by channel catfish, the effect of fish size on feed conversion efficiency, and feed consumption by channel catfish as a function of water quality. Results show that maximum feed consumption by channel catfish is not affected by morning dissolved concentration of two parts per million (ppm) or afternoon ammonia concentration of 0.5 ppm if only one of the factors is stressful, but if both factors occur on the same day, feed consumption is significantly lowered. Mid-size catfish (mixture of large and small fish) grow equally well if fed 28% or 32% protein feeds, but a greater fraction of total yield comes from the smaller fish when the population is fed a 32% protein feed. Catfish larger than three pounds convert feed less efficiently than smaller fish, making growing to the three-pound size less profitable than the 1.5-pound size
α. **Impact:** This information will help catfish producers make better use of their feed to raise higher quality fish at a lower price and also protect the environment.
β. **Source of Federal Funds:** Hatch
χ. **Scope of Impact:** State Specific

a. **Statement**: An Auburn University project uses electron and laser scanning confocal microscopy combined with antibodies that allow visualization of sensory structures in developing oyster larvae. Eventually, pharmacological probes will be used to examine oyster larvae responses to substances involved in the process leading to induction and the change to the adult form. This project started in 1998 and should be completed by 2003.

α. **Impact:** Serotonergic nervous system structures similar to those seen in other molluscs have been identified in oyster larvae. Some of these structures are associated with a known sensory organ (the apical sensory organ) that is thought to be involved in sensing the chemical cue that induces metamorphosis. Nerve tracts from the serotonergic neurons in the apical sensory organ extend into the larval tissues to structures/organs that are involved in feeding and that undergo changes during metamorphosis. Results thus far suggest that this serotonergic system is critical to larval functions and possibly important in participating in the metamorphic event.

β. **Source of Federal Funds:** Hatch

χ. **Scope of Impact:** State Specific

a. **Statement:** Researchers at Auburn University are addressing the genetic improvement of catfish through the use of modern genetics. Specifically, they have developed thousands of DNA markers, which can be used to differentiate the fish with different characteristics. These markers will be used for making genetic maps and for marker-assisted selection. A genetic map is like a road map that can direct the directions for genetic work toward genetic improvements. The project began two years ago and it is continuing. More and more genetic information and technologies will be revealed and developed to speed up the breeding programs.

α. **Impact:** This project is expected to provide several benefits. It will generate the first-ever detailed genetic linkage map of channel catfish and produce information for markers that are linked to important economic traits -- resistance to diseases and improved growth and carcass yield. The catfish genetic linkage map will fill the genomic research gap in the most important cultured fish in the United States. Such a map will be useful for catfish breeding programs. Markers identified to be linked to economic traits will be immediately useful for marker-assisted selection and for mixing genes for combined benefits. Any progress made in disease resistance or better growth will translate into increased profit for producers and reduction of losses. A large part of the value of this project depends on the efficient transfer of information and technology to the catfish industry and to other investigators. The researchers therefore intend to continue to make any markers, primers, and resource DNA available to interested parties. All the relevant information will be listed on their website (http://www.ag.auburn.edu/genemap) immediately when appropriate. Linked markers to disease resistance will be made available to the catfish industry for use in marker-assisted selection.

β. **Source of Federal Funds:** Hatch

χ. **Scope of Impact:** State Specific

a. **Statement:** An on-going effort at Auburn University is looking at the many factors that affect water quality -- the composition of feeds, feeding strategies, water quality management techniques (aeration, etc.), and fish (usually catfish) population structure.

They have explored ways to better manage all these factors so fish grow efficiently and water quality is protected.

α. **Impact:** This research saves producers money and also saves water supplies from potential pollution.

β. **Source of Federal Funds:** Hatch

χ. **Scope of Impact:** State Specific

a. **Statement:** Auburn University shrimp production research is underway in small coastal ponds about a quarter-acre in size and in tanks in greenhouses. Scientists have studied how well different species grow in Alabama, how densities affect production and economics, and how to best manage water in the ponds to promote good shrimp growth while ensuring minimal discharge.

α. **Impact:** To date researchers have learned that marine shrimp can be grown in Alabama and that the economic potential is greatest when shrimp are grown for bait. It has been learned that pond flushing is not necessary during culture; that water quality can be maintained with good aeration and careful feeding practices. In addition, they have found that most of the excess nutrients, such as nitrogen and phosphorus, are discharged with the last 10-20% of the pond water at harvest. If this water is pumped to settling ponds and held for 12-24 hours, more than 80% of the nutrients will settle and very minimal effects will occur to the receiving environment.

β. **Source of Federal Funds:** Hatch

χ. **Scope of Impact:** State Specific

a. **Statement:** Auburn University researchers have been examining the functioning mechanism of artificial reefs: can they be used to increase red snapper production, can we obtain more accurate red snapper stock assessments through fishery independent sampling of Alabama's artificial reefs, and can artificial nursery habitats be used as an alternative solution to shrimp trawl by-catch mortality problems, for increasing survival of young red snapper?

α. **Impact:** The most significant and unique result to date has been the apparent affinity by young red snapper for shell habitats. In coastal Alabama, researchers have demonstrated a critical nursery area for red snapper that far exceeds all other areas in the Gulf of Mexico. This area consists of relic fossil shell that provides shelter for young red snapper. Recently (1998-1999) they have shown that such habitats could be artificially created and attract a very large number of young red snapper. Thus great potential exist to attract young red snapper away from areas of intensive shrimp trawling to areas with little or no shrimp trawl by catch mortality is expected.

β. **Source of Federal Funds:** Hatch

χ. **Scope of Impact:** State Specific

a. **Statement:** Alabama has the largest artificial reef program in the nation, with more than 14,000 ocean-floor reefs providing habitat for a wide range of commercial and sport fish in the Gulf of Mexico. The reefs off coastal Alabama have been a boon to the commercial and sport fishing industries, as catches of popular reef fish such as red snapper and gray triggerfish have increased dramatically through the years. Though the success of these reefs is undeniable, no one has ever explained why they are so effective in attracting certain species of fish. One popular theory is that the reefs provide a new

link in the food chain. Over time, corals, sponges, and other encrusting organisms take up residence on the reef. Small fishes come to feed on these organisms, and larger fishes are drawn to feed on the smaller. A complete reef food web is created. To date, however, the food chain theory has not been scientifically proved. To determine whether artificial reefs actually produce food and cause the food chain effect, Auburn University researchers in Fisheries and Allied Aquacultures are studying the diets and populations of red snapper, gray triggerfish, and other commercially and environmentally important fish and aquatic animals in reef habitats.

α. **Impact:** Results suggest that the reefs are providing food and thus ideal habitats for a wide range of fishes. Knowing more about how these reefs affect marine animal populations will help Alabama retain its vital commercial and sport fish industries, protect populations of various aquatic animals, and answer basic questions about aquatic life beneath the Gulf Coast waters.

β. **Source of Federal Funds:** Hatch

χ. **Scope of Impact:** State Specific

a. **Statement:** Researchers at Auburn University have been working on understanding the interactions among fishes and other aquatic organisms for many years. They have focused on interactions among sport fishes (bass and bluegill) and prey fishes (shad) as well as invertebrates such as snails, mussels, and crayfish. They work at all levels, from laboratory experiments, to pond manipulations, to entire mainstream impoundments.

α. **Impact:** This information will help Alabama better manage their natural resources. Results of the work have already produced management recommendations for agencies such as the Alabama Game and Fish Commission and U.S. Fish and Wildlife Service.

β. **Source of Federal Funds:** Hatch

χ. **Scope of Impact:** State Specific

Key Theme: Water Quality

a. **Statement:** Auburn University researchers have selected a small watershed within the Flint Creek Watershed in north Alabama has been instrumented to monitor runoff and runoff water quality. The instrumentation includes: a two-foot H-flume to measure runoff, an automatic runoff sampler, and rain gages. The runoff samples are analyzed to determine non-point source pollution (NPS) pollutants such as sediment, nitrogen, and phosphorus. The results will be used to calibrate for a water quality computer model, which simulates runoff and water quality. The model with calibrated parameters may be used to evaluate the effects of various best management practices (BMPs) of pasture grazing on NPS pollution.

α. **Impact:** The results will provide information on the effects of current grazing practices on NPS from the study site. With the computer simulation model of water quality, various BMPs will be evaluated without expensive field monitoring.

β. **Source of Federal Funds:** Hatch

χ. **Scope of Impact:** State Specific

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

a. **Statement:** The elderly population is increasing in America as well as in Alabama. Focus has been growing in regards to health and well-being for the elderly as they are living longer. The Alabama Commission on Aging has stated that there are approximately 736,122 elderly Alabamians over 60. In providing care, through either home health or assisted living facilities, specific needs with regard to clothing (e.g., style, self-help features, ease of cleaning) have surfaced. Because of physical limitations brought about by ailments like arthritis, changes in skeletal makeup, lessening of dexterity and decreasing body temperatures, clothiers are being challenged to look at these needs more seriously. Some of the suggestions are to have larger armholes thereby lessening restriction; using larger buttons, more zippers and/or pressure-tape (Velcro) closures. Researchers at Alabama A&M University are taking an active part in gathering data to show the attitudes and preferences toward dress of assisted-living elders and their primary caregivers. The objectives were to 1) describe the attitude and preferences of seniors toward their general mode of dress; 2) describe attitudes and preferences of caregivers toward dress for the seniors in their care; 3) determine factors which contribute to seniors' feelings of adequacy/satisfaction with their dress behaviors and/or practices; and 4) determine the relationship of clothing interest/importance of caregivers to their attitudes toward dress for seniors. A descriptive (face-to-face interview) survey was given to 100 elders and their caregivers (200 participants) in north and south Alabama in order to explore the objectives of the study.

α. **Impact:** Understanding both, the dress behaviors and concerns of seniors are very important. Currently, existing training materials are theoretical in nature. This data offers actual statistics to enhance information to be disseminated to the general public and caregivers for the elderly.

β. **Source of Federal Funds:** Evans-Allen

χ. **Scope of Impact:** State Specific

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

a. **Statement:** The teaching, research and outreach activities of our universities demand that students entering the next phase in training for or practicing a career in foods and agriculturally related sciences must have the skills needed to operate in a technologically sophisticated society. This requires that colleges of agriculture and K-12 teachers form partnerships in developing science curricula or programs that show the importance and impact of food, agriculture and environment in our daily lives. To encourage and increase minority enrollment in the foods and agriculturally related sciences, Tuskegee University is using the *1890 Mobile Environmental Science Classroom Program* model in K-12 schools in minority and underserved communities. The aim of the program is to stimulate and educate students in the scope of environmental education and agriculture as sciences with applicability to daily living. The program takes the form of bringing principles, activity and equipment used in agricultural environmental scientific research into the classroom.

α. **Impact**: Participating middle school and high school students were taught through practice, the theory and application of basic science and math as these relate to their lesson topics and the environment. They also examined human activities on surface and groundwater, extraction of peanut oil, composition of peanut and the major component of

milk. Student participants showed excitement for acquiring knowledge. Ten of these students have participated further in the GWCAES summer internship program and have shown interest in enrolling in math and science programs in college.

β. **Sources of Federal Funds:** Evans-Allen

χ. **Scope of Impact:** State Specific

Key Theme: International Collaborations

a. **Statement:** Policy makers and researchers in Sub-Saharan Africa (SSA) are faced with numerous challenges in addressing the imbalances of food production and population growth. These imbalances can be addressed through the process of capacity building in key frontline areas: the development of effective policies to facilitate trade and the introduction of appropriate techniques that harmonize compliance with international trade agreements. One of the major impediments to free trade and to some extent investment is the use of emerging technologies which could greatly benefit developing countries especially in Sub-Saharan Africa has been the issue of technical barriers to trade. While the U. S. position in accordance with WTO has been to base decisions that pertain to special phyto-sanitary or food safety related decisions on good science, there has been an increasing level of opposition publicized by mostly non-specific groups in mass media that has influenced policies and regulations. In order to assist Sub-Saharan African nations in solving their food security problems and increase trade, the 1890 institutions, with Tuskegee University and Alabama A&M University as the lead, formed a partnership with 26 Sub-Saharan African countries, USDA/ARS/FAS, the CGAIR System, FAO, UNEP, and private organizations to engage African scientists and their institutions and policy makers in providing science-based information to government and the general public on technical matters that impede trade, agricultural production and food security.

α. **Impact:** Over 150 participants from three regions of Africa – East, West/Central and Southern Africa as well as from the 1890 Land-Grant Universities, FAO, UN, UNEP and the CGAIR System and other non-governmental organizations and private companies participated in a workshop in Accra, Ghana to develop strategies for the use of Biotechnology in African Agriculture. The participants jointly planned and unanimously agreed upon the scope of the activities of the alliance.

β. **Source of Federal Funds:** USDA

χ. **Scope of Impact:** AL with GA, LA, MS, TX, TN, MD, SC, NC, VA, AK, OK, MO, KY, FL

Goal 2: A Safe and Secure Food and Fiber System

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

Overview

The safety of the food supply is a major concern to policy makers, consumers, distributors, processors, producers, and suppliers. Enhancing the quality and safety of our food supply requires continuous innovation in production, processing, packaging, and distribution practices. 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 surface contamination on fresh fruit and vegetables by human pathogens. 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 initiated research programs that are aimed at developing procedures for using low dose UV and Gamma Radiation to prolong storage of fruits and vegetables. Other researchers are using natural antimicrobial agents to control food borne pathogens in meat and egg products.

The research at Alabama A&M University is focused on finding solutions to the problem of allergenicity of peanuts and to improving the texture, tenderness and taste of poultry meat.

The accomplishments and results of the research efforts thus far are encouraging. The success of this research 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. Further, 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.

Inst.	FY 2000		FY 2001		FY 2002		FY 2003		FY 2004	
	Approximate Expenditures	SY	Projected Expenditures	SY	Projected Expenditures	SY	Projected Expenditures	SY	Projected Expenditures	SY
1862 (AL)	4,837,516	23	4,424,199	13	4,645,409	13	4,877,680	13	5,121,563	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	264,567	3	277,795	3
Totals	5,253,509	26	4,781,035	17	5,020,086	17	5,271,090	17	5,529,643	17

Allocated Resources ($) and Scientists Years (SY).

Key Theme: Food Safety – Animal Products

a. **Statement:** Salmonella, E. coli 0157: H7 and Listeria monocytogens are serious food borne pathogens that are found in common foods like milk, other dairy products, beef, seafood as well as fresh fruits and vegetables. Scientists at Tuskegee University are developing methodology to make eggs safer from Salmonella enteridis and Listeria moncytocytogenes by the addition of lysozyme and lactoferian B with EDTA before pasteurization.

α. **Impact:** Addition of lysozyme and lactoferian B with EDTA before pasteurization was found to eliminate both pathogens from liquid egg products. This method reduces the D value for both pathogens. Addition of these antimicrobial agents also reduced the pasteurization period as well as the temperature needed.

β. **Source of Federal Funds:** Evans-Allen

χ. **Scope of Impact:** State Specific

Key Theme: Food Safety – Fruits and Vegetables

a. **Statement:** In an effort to extend shelf life of selected fresh fruits and vegetables, studies were initiated at Tuskegee University to study the efficacy of using low dose UV radiation to control post harvest storage pathogens. The pathogens studied included Aspergillus niger (An-13) Stemphylicem vesicarium (SV-7), collectotrichum capsici (coll-159) Collectrotrichum gloesporidis (Coll-153), and Xanthomonas campestris PV. Vesicatonic No. XVT28. These pathogens were associated with onions and peppers.

b. **Impact:** Suspensions of these pathogens were exposed to several doses of UV—C light up to 20KJ/m^2. Results thus far show that except for A. niger, low UV-C light up to 20KJ/m^2 was able to eliminate the pathogens. The least resistant was x. campestris.

c. **Sources of Federal Funds:** Evans-Allen

χ. **Scope of Impact:** State Specific

a. **Statement:** Since Auburn's fruit and vegetable surface contamination project began, researchers have looked at tomatoes, apples, cucumbers, and strawberries and used several washing techniques to kill the bacteria on the surface of these fruits and vegetables. Along with looking at the effectiveness of the destruction of the bacteria, researchers also are looking at the effect treatments have on the quality of the produce, including vitamin content and fruit structure and texture.

c. **Impact:** By finding an effective method to kill the bacteria on the surface of fruits and vegetables, consumers can continue to enjoy a healthy diet of fresh produce without the fear of getting a food-borne disease.

χ. **Source of Federal Funds:** Hatch

δ. **Scope of Impact:** State Specific

Key Theme: Genetic/Biochemical Modification of Foods

a. **Statement:** Protein, the building block of life, makes up the mass of every life form and is essential in the diets of all animals. It also is the tie that binds DNA molecules in their

spiral forms. Understanding proteins is a key step in deciphering myriad health and nutrition problems, as well as a giant step in decoding genetic mysteries. Auburn University researchers are becoming intimately familiar with the molecular structure of proteins through their Nobel-quality biochemical work. A part of Auburn University's Peaks of Excellence program, proteomic research is focusing on molecular processes that, if disturbed by genetic, pathogenic, or environmental factors, affect the well being of humans, animals, and plants.

α. **Impact:** Already the researchers have identified and even mapped proteins that link DNA strands into a chromosome. Once these basic processes are understood, the information can be used to optimize the efficiency or direct the nature of biological processes. Using these tools, scientists will better understand how organisms adapt to changing environmental conditions in the wild and may also lead to the design of pharmaceutical agents and genetically modified organisms with medical or other commercial value.

β. **Source of Federal Funds:** Hatch

d. **Scope of Impact:** State Specific

a. **Statement:** For years, scientists have studied and tried varied techniques to improve upon the foods we consume - whether it is quantity, size, color, texture, taste or aroma. At Alabama A&M University, researchers have injected living broilers with dantrolene sodium (DS B 5 mg/Kg-body weight) to produce more tender breast meat when harvested (at least one hour post mortem). Although the chemical process that took place is not fully clear, it was definite that untreated broilers were tougher. Further investigation proved that the meat samples from carcasses that had received electrical stimulation (ES) were more uniformly tender, than those samples having received DS injections. These results indicate that a calcium channel blocker can be successfully used to prevent the toughness associated with early harvested broiler meat. This finding could be significant in the poultry industry in the US in that, the final product to the consumer could be significantly cheaper without any reduction and possibly an increase in profit to the poultry meat producer. States such as Arkansas, Alabama and Georgia would be highly impacted in this regard. However, since DS is not afforded GRAS status and intravenous delivery is inefficient, a water-soluble calcium channel blocker with potential GRAS status needs to be investigated before any possibility of commercial application.

α. **Impact:** The economics of poultry (particularly broilers) producing states such as Arkansas, Alabama and Georgia could be greatly benefited with the commercialization of this processing technique. More meat would be processed using current processing facilities without any additional capital outlay. Potential injuries to workers are not increased and the prevention of toughness would be more uniform and predictable. Manpower and utilized energy from storage coolers would be more efficiently utilized.

β. **Source of Federal Funds:** Evans-Allen

χ. **Scope of Impact:** State Specific with AL, AR, GA and any other poultry producing state

a. **Statement:** Auburn University researchers began a new project in 1999 to delineate genomic and proteomic mechanisms by which pigs control their fat metabolism. While scientists have long understood the overall aspects of fat metabolism, there is little real knowledge of the biological mechanisms that affect fat deposition in muscle tissue. The researchers are studying the intracellular machinery of fattening in pork tissue by isolating (cloning) and sequencing key target genes in the fatty acid synthesis pathway.

They also are exploring the role of the nuclear (cell nucleus) regulatory genes on the activity of metabolic pathways involved in fattening.

b. **Impact:** By learning more about the fattening process in food animals, the researchers will be able to help the biotech industry, feed suppliers, nutritionists, and animal management experts develop breeding, feeding, and pharmacological strategies for efficient production of safe, tasty, and healthy muscle foods. This information may also be transferable to humans.

c. **Source of Federal Funds:** Hatch

χ. **Scope of Impact:** State Specific

Key Theme - Food Safety and Risk Analysis

a. **Statement:** Peanuts have been identified as a potent food allergen responsible for life threatening immunoglobulin E (IgE) reactions among hypersensitive individuals. There is a need to molecularly characterize the genes encoding the target proteins and to understand the nature of their regulation. Thus, at Alabama A&M University, scientists have completed the following objectives. 1) To isolate sequence and analyze genomic clones encoding Arah II major allergens; 2) To design an antisense construct of peanut Arah II cDNA and genetically transform peanut tissues via particle bombardment; and 3) To regenerate transformed embryonic tissues. The determination on the level of down regulation of the allergens is still in progress pending transgenic tissues becoming available for testing. For the first time, the results revealed information on the structure of a major peanut allergen Arah II. Comparison of the cDNA and genomic sequences revealed the absence of an intron but the presence of two isoforms of Arah II or different members of the same gene family.

α. **Impact:** The first genomic clone of a peanut allergen gene has been cloned and characterized. In addition to the molecular features and special gene structure, the potential for a gene family in Arah II and the presence of at least two isoforms between the cDNA and genomic clones exist. Potentially, thousands of deaths due to peanut consumption by persons with peanut allergy could be prevented with the development of an allergen free peanut. With the current increase of peanut allergies, there is an urgent need to molecularly characterize the genes encoding the target proteins and to understand the nature of their regulation.

β. **Source of Federal Funds:** Evans-Allen

χ. **Scope of Impact:** State Specific with AL, NY

Goal 3: A Healthy, Well Nourished Population

State Program: ***Improve Human Nutrition and Health***

I. 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 shiitake mushrooms and its role in nutritional diets. They also are evaluating the diets of the elderly population residing in other assisted living long-term facilities and congregate feeding programs.

At Tuskegee University, scientists have initiated a research program, which focus 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, which evaluates the nutrition compositions of foods, including factors that affect shelf life.

The accomplishments thus far have resulted in development of recipes utilizing novel vegetable sources of high omega three fatty acids, i.e., sweetpotatoes 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 lines of older citizens. The research remains on target with stated objectives.

Inst.	FY 2000		FY 2001		FY 2002		FY 2003		FY 2004	
	Approximate Expenditures	SY	Projected Expenditures	SY	Projected Expenditures	SY	Projected Expenditures	SY	Projected Expenditures	SY
1862 (AL)	2,227,188	4	2,392,964	10	2,502,652	10	2,628,118	10	2,463,300	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	2,707,420	13	2,832,829	13	2,974,803	13	2,827,318	13

Allocated Resources ($) and Scientists Years (SY).

Key Theme: Nutrient Composition of Foods and Nutrition Education

a. Statement: Sweetpotato green tips and purslane have been shown by Tuskegee University scientists to contain nutritive components that are sources of cardiovascular disease (CVD) preventive factors such as omega-3 fatty acids, dietary fiber, antioxidants

phytochemicals, etc. Studies were therefore initiated to develop and evaluate recipes utilizing sweetpotato tips and purslane as novel vegetables sources for omega – 3 fatty acids; to evaluate the fatty acid composition and plant sterol content of both green vegetable sources, and to identify and quantify other compounds in these novel vegetables that will reduce CVD risk.

α. Impact: Two strategies involving a clinical research study, food and nutrition education activities were used to implement the proposed activities of the research. The clinical research was conducted during two 6-month periods and focused on decreasing CVD risks. During period I sweetpotato green tips (SPGTs) high in the recognized cholesterol-lowering components, omega-3 fatty acids and dietary fiber was incorporated into the diet. Soybeans containing the same components were fed during period II. The effects of these foods on changing serum cholesterol and other blood lipids was studied in 50 participants (25 test and 25 control) in both the SPGT and the Soybean studies. The focus group approach was used to develop food and nutrition educational materials that assisted in teaching people how to lower their SVD risk. Subsequent to the end of the clinical study, participants returned to their home communities to serve as community leaders in organizing and developing strategies for reducing CVD risk.

β. Source of Federal Funds: Evans-Allen

χ. Scope of Impact: State Specific

a. Statement: Auburn University researchers are studying the factors that affect shelf life of foods. Experiments are evaluating the effect of a given ingredient of physical condition on a specific food deteriorative reaction. For example, the effects of ingredients (e.g., sugars), water, and matrix physical structure on protein stability will be evaluated. The effect of porosity on discoloration reactions will be studied. The project started in 1994 and could run another three to four years, if not further.

α. Impact: Over the past five years, several research areas have been explored. Phosphate buffer salts were found to increase ingredient breakdown and discoloration as compared to citrate buffer. Tyrosinase stability in solids was found to be influenced by the physical characteristics of the solid (glass transition temperature) whereas invertase stability was influenced by the presence or absence of water. The presence of pores in solids appears to increase chemical reactivity. By understanding a specific food deteriorative reaction and the factors that influence its rate, food quality and product shelf life can be optimized.

β. Source of Federal Funds: Hatch

χ. Scope of Impact: State Specific

a. Statement: Mushrooms have been used and respected for a long time in other countries for their uses in medicinal practices. They have also been known for their value as healthy foods that are low in calories, but high in other minerals, vitamins and vegetable proteins. A study at Alabama A&M University was done to analyze and compare the nutrient composition of shiitake mushrooms (Lentinula edodes) grown on sweetgum logs inoculated with two different shiitake mycelia/strains (WW44 and WR46), and to compare the nutrient composition of shiitake mushrooms harvested from sweetgum logs soaked in three different soaking solutions of nitrogen, sugar, and regular water. The mushrooms were grown at the Winfred Thomas Agricultural Research Station. Analysis was conducted on each sample for the content of the following nutrients: carbohydrates, crude fiber, protein, moisture, fat, ash, magnesium, calcium, zinc, potassium,

phosphorous, chromium, iron, copper, and sodium. An analysis of variance was done to compare the levels of different nutrients. Shiitake mushrooms from sweetgum logs inoculated with strain WW44 had significantly higher fat, moisture, zinc, potassium, and phosphorous content than mushrooms from WR46 inoculated logs. Mushrooms from logs soaked in a sugar solution and those from nitrogen solution soaked logs had significantly higher magnesium content. Mushrooms from logs soaked in a sugar solution had the highest zinc and potassium content. Mushrooms from logs soaked in regular water had significantly higher carbohydrate content and lower potassium content. Strain WW44 mushrooms had a relatively high nutrient content and mushrooms harvested from the sugar solution soaked sweetgum logs had relatively high levels of more nutrients than mushrooms from logs soaked in regular water and nitrogen solution.

α. Impact: The ability to manipulate strain types and soaking treatments to initiate fruiting in sweetgum logs inoculated with shiitake mycelia has proven to affect the nutrient content in shiitake mushrooms. These results enable growers to produce healthier shiitake mushroom for the consumer. In addition, efforts are being made to increase the yield and availability of the shiitake, which would increase the economic return for the farmers and the sellers.

β. Source of Federal Funds: Evans-Allen and Capacity Building Grant

χ. Scope of Impact: State Specific

Key Theme - Diet Modification for Targeted Populations

a. Statement: Healthy food consumption is a concern for all ages; however, the need for different and more nutritious foods becomes an even greater focus as we age. Part of our enjoyment of food comes from the ability to taste and smell it. Therefore, researchers at Alabama A&M University conducted a study on elderly males and females between the ages of 61-95 residing in assisted long-term facilities and congregate feeding programs. Odoriferous compounds were used to determine the importance of memory, experience, and degree of articulateness in describing odors. Each participant sniffed the odor of foods and non-foods and tried to identify and/or give descriptions. A number was assigned to each odoriferous sample using a scale with parameters representing accuracy of identification, frequency or use, and ease of recognition. The long-termed care facilities results indicated that 50% described the odor, 35% recognized the odor compounds but confused the odor with a similar odorant, i.e., lemon for lime. Fifteen percent (15%) identified the odorant exactly. Although their sense of smell is diminishing to a certain degree, some elderly can recognize odors through association even if not by name. For some participants (50%), continual smelling of the odorants decreased the perceived intensity causing a tingling sensation in the nasal cavity. Similarly, participants in the congregate feeding programs could detect a stimulus of the odorant although many were unable to identify or describe what they had smelled. They could associate the smells but the intensity level of all the odorants was rated as mild. Gustatory evaluation tested the ability to taste (i.e., control taste paper, PTC taste paper, sodium benzoate taste paper and thiourea taste papers). Taste papers were placed on the tongue. The results showed that 75% of the elderly noted no taste from the PTC paper (nontasters). The same percent noted a bitter taste from the thiourea taste paper denoting keen acuity of bitterness. The congregate feeding programs yielded the same outcome. The sodium benzoate results of sweet, salty and bitter (45%) although 55% noted other responses or non-responses.

α. Impact: The results from this study were useful in maintaining the primary reinforcement to eat - taste and smell. Taste and smell also aided in the elderly in selecting appropriate foods and portion sizes. Another benefit from the outcome of this study is in helping in preventing the consumption of poisonous substances and overdosing on some medications that usually have a bitter taste.

β. Source of Federal Funds: Evans-Allen

χ. Scope of Impact: State Specific

Goal 4: Greater Harmony between Agriculture and Environment

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

Overview

Society demands that our quality of air, water, and soil be protected. Contamination of these resources and food, 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. Considerable agricultural waste and residues are generated through the animal, poultry, and crop production systems in Alabama. In a sustainable agriculture system, these residues and waste could be incorporated into the soil to enhance soil productivity, improve water infiltration and 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 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, as well as the productivity of soils and the systems that affect them.

Alabama A&M University researchers are evaluating 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 accomplishments thus far are encouraging and are on target with stated objectives. The ultimate goal is to use the data 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 for 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.

Inst.	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004

	Approximate Expenditures	SY	Projected Expenditures	SY	Projected Expenditures	SY	Projected Expenditures	SY	Projected Expenditures	SY
1862 (AL)	12,538,179	36	13,317,485	38	13,983,359	38	14,682,527	38	15,416,654	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	295,925	2	310,721	2
Totals	13,051,181	39.5	13,678,509	41	14,362,433	41	15,080,553	41	15,834,582	41

Allocated Resources ($) and Scientists Years (SY).

Key Theme: Water Quality and Waste Management

a. Statement: An estimated 1.8 million tons of poultry litter per year is generated by the broiler industry in Alabama. Application of the broiler litter to agricultural lands has been seemingly an inexpensive solution to the disposal problem. This has, therefore, resulted in environmental concerns with regards to agricultural ecosystems and groundwater contamination in areas where the poultry litter is applied to agricultural land. Researchers at Tuskegee University are therefore developing methods of assessing the long-term effect of this method on the soil environment and the groundwater quality

a. **Impact:** Results of the study have shown that mineralization of the broiler litter depended on the soil type and the C/N/S ratio of the broiler litter. Data has also been generated on the analysis of broiler litter (pH, total nitrogen, total phosphorus, ammonium nitrate and organic carbon 19 trace elements) of 33-broiler litter producing sites in the state of Alabama. This data will be used to develop and effective broiler litter management strategy for different soil types in Alabama.

α. **Source of Federal Funds:** Evans-Allen

β. **Scope of Impact:** State Specific

a. **Statement:** Production of shiitake mushroom using composted poultry litter is an effective way to dispose of the litter and use its nutrients. By increasing the yields of shiitake mushrooms, using various production interventions producers can earn more and shiitake mushroom prices at the market can potentially be lower. Alabama A&M University researchers inoculated three hundred sweetgum logs were by to establish the nutrient supplementation rate and source portion of this research. The nutrient supplements were ammonium sulfate, ammonium chloride, sulphur-coated urea and urea applied at three rates and two times during the life of the logs. The sweetgum logs were inoculated with strain WR46. Supplies and equipment have also been obtained to begin the sawdust block/poultry litter/nutrient supplementation experiments. Three hundred sawdust blocks were formulated using sulphur-coated urea, resin coated urea, composted poultry litter, soy flour and yeast extract at various rates and combinations. Articles on mushrooms are being summarized and web page development progresses.

α. **Impact:** Although no quantifiable results have been attained yet, the goal of this research is to increase the yields of shiitake. This will increase returns to producers with a minimal increase in inputs. It is anticipated that a 0.1-pound per unit increase in yields could result in a $400 increase in returns per 100 sawdust blocks. Large commercial producers generally fruit 2,000 to 4,000 blocks per year. The total increase in returns on a 0.1-pound per block increase in production would result in $8,000 to $16,000 per year.

β. **Source of Federal Funds:** Evans-Allen and State Agricultural Experiment Station

χ. **Scope of Impact:** State Specific

a. **Statement:** Vast amounts of animal by-products are becoming an environmental challenge. Finding safe ways to utilize and dispose of this waste is calling upon creative and intelligent means. Alabama A&M University scientists conducted a cotton field experiment at the Belle Mina, AL sub-station. Using twelve treatments and four replications, the experiment included three tillage methods, two cropping systems, and two sources of nitrogen. In addition, a no-nitrogen control and a continuous weed free bare fallow treatment were included. In 1999, a nutrient uptake study was conducted in these plots using corn as the uptake crop. The results indicate that no-till system produced significantly better cotton lint yield compared to mulch till and conventional till systems. Poultry litter improved cotton lint yield as well as commercial ammonium nitrate. The surface applied poultry litter influenced cotton significantly under no-till system. These results have significant practical implications as the combination of no-till and surface poultry litter application reduced soil erosion, as estimated with RUSLE computer program, and improved organic matter significantly. The GOSSYM-COMAX model could predict cotton growth parameters required to use the RUSLE computer program under conventional tillage system but not under conservation tillage system or with additional increased complexity of poultry litter application and rye crop rotation.

α. **Impact:** Increased utilization of poultry waste in no-till cotton is helping to solve the Issue of safe disposal of poultry waste and increases the organic matter levels in cotton fields.

β. **Source of Federal Funds:** Evans-Allen and State Agricultural Experiment Station

χ. **Scope of Impact:** State Specific

a. **Statement:** Soils that have been over fertilized with animal manure have the potential to lose phosphorus (P) to surface waters. Also, P laden soil particles can be lost by erosion. That can result in excessive plant growth due to entrophication in surface waters. It is important to find ways to significantly reduce these excessive soil P levels. A soil with high residual P from poultry litter application was amended with an additional 200 and 400 kg/ha or unamended then planted with five forage crop species. Only the sorghum sod grass hybrid cv unigrass II produced harvestable forage in 2000. Total P uptake was 36, 41 and 47 kg/ha respectively with background P and 200 or 400 kg/ha of added P. All plots were over seeded with triticale in the fall to obtain winter P uptake. Remote sensing and GIS work is planned.

α. **Impact:** Ultimately the nutritive value/content of the soils impacts growers/farmers and their profitability. They want to maintain optimum levels of these nutrients in the safest and most economical manner. It appears that perhaps high yielding forage crops can be used to reduce high soil P levels such as those that exist where excessive rates of manure have been applied.

β. **Sources of Federal Funds:** Bureau of Land Management

χ. **Scope of Impact:** State Specific

Key Theme: Water Quality and GIS

a. **Statement:** Groundwater is the main source of drinking water for a majority of rural populations in the state of Alabama. Increased use of agricultural pesticides and fertilizers has raised serious concerns about groundwater contamination. The Geographical Information System (GIS) and the use of generic models can predict the potential contamination of groundwater and help to employ appropriate management practices. Scientists at Tuskegee University are using a DRASTIC model, based on seven hydrological settings to generate indices to classify the potential vulnerability of ground water on 3 (three) black belt counties.

α. **Impact:** Using GIS in conjunction with the DRASTIC model has helped to process, store and display; retrieve and update more than 200 spatially referenced well water data. The compilation of computer-generated thematic maps can assist in predicting potential groundwater contamination and assist in developing and adopting appropriate mitigation practices.

β. **Federal Funding Source:** Evans-Allen

χ. **Scope of Impact:** State Specific

Key Theme: Soil Conservation

a. **Statement:** In order to sustain and encourage economic development and ensure sustainability of the small limited-resource farmer, methods for controlling soil erosion and water runoff are needed to make these lands more productive. Scientists at Tuskegee University have initiated a research program to assess the impact of grass hedges on soil erosion and soil conservation under limited-resource farm practices.

α. **Impact:** Several grasses (Eastern gamagrass, giant reedgrass, switchgrass and vetivergrass) were evaluated for their effectiveness in reducing erosion and for their forage quality. Results, thus far, indicate that grasses that were planted at distances of 30 and 45 cm apart formed effective barriers that reduced water movement down the slope. Giant reedgrass grew more than 3.5 meters and shaded the economic alley/intercrops. Some of these grasses produced high biomass that can be used as animal feed for the small farm operation.

β. **Sources of Federal Funds:** Evans-Allen

χ. **Scope of Impact:** State Specific

Key Theme: Urban Issues and the Environment

a. **Statement:** Agricultural and industrial production is essential for economic development and the economic well-being of the community. The production activities generate employment, income and tax revenue for the public sector. These activities however can also generate both point source and non point source pollution. Point source pollution generated by industrial production affect the quality of the environment, which impact human and animal health, vegetation and physical structures. Researchers at Tuskegee University are developing an integrated economic-environmental model to assess both the economic impact of the production activities as well as assess the level of pollutant that would be generated by the economic activities.

α. **Impact:** An extended input-output model was developed and applied to major industries of Jefferson County in Alabama. The model incorporated the technology used by the different plants and reflects the input used and the chemical emission. Results thus fare of the extended input-output model developed for Jefferson county show that there is a concentration of industrial activity in and around Birmingham and thus most of the plants generate more volatile organic compounds that greatly contribute to the smog level. With the refinement of the model, it can be applied to any county in Alabama and can be used by policy makers in deciding industrial locations.

β. **Sources of Federal Funds:** Evans-Allen

χ. **Scope of Impact:** State Specific

Key Theme: Integrated Pest Management

a. **Statement:** Major constraints to horticultural crop production in Alabama are pests and diseases. This has resulted in a heavy reliance on the use of pesticides for maximum crop production and pest control; however, the utilization and dependency on chemical inputs pose serious environmental concerns and on the development of resistance of pests to these pesticides. Scientists at Tuskegee University are therefore looking at alternative ways of controlling pests through integrated pest management approaches. One of the approaches is by the use of soil solarization to control soil and foliar pathogens of vegetable crops through plasticulture techniques.

a. **Impact:** Soil solarization studies have shown effective weed control and reduction of disease incidence of some of the foliar fungal and virus diseases. The integration of a biofungicide, furfural, resulted in further disease control and increase yield.

α. **Source of Federal Funds:** Evans-Allen

β. **Scope of Impact:** State Specific

Key Theme: Remote Sensing and Precision Agriculture

a. **Statement:** Remote sensing/precision agriculture work by Auburn University is being conducted on a large farm in the Tennessee Valley portion of Alabama. Past work has evaluated the correlation of remotely sensed data with grain yield collected with yield monitors. Current work is addressing the possibility of using aircraft flown remotely sensed data to evaluate surface soil properties. Researchers are currently using collected data to investigate the use of remote sensing data to assess and quantify soil organic matter (which is related to yield), and soil mineralogy. The mineralogical attributes of golf course amendments used in green construction have been thoroughly evaluated with

regard to adsorption of three commonly used turf pesticides. Future work will evaluate the retention of other pesticides, as well as examine the effect of amendment modification (e.g. some amendments are fired) on retention properties. Soils possessing highly weathered mineralogies have been thoroughly evaluated. Current work is using modeling programs to interpret x-ray diffraction and thermal data to more adequately describe soil minerals. Through better characterization of soil systems, we can better interpret how they may respond to a particular use or how they may behave under different management. The turfgrass compaction study has shown significant response to soil compaction occurs as detected by turfgrass spectral reflectance. However, it is premature to state that timing of compaction relieving activities can be based on reflectance. These spectral reflectance signatures exhibit a high degree of temporal variability.

α. **Impact:** The researchers have shown that remotely sensed data can be used to depict management zones for row crop operations. These zones may be managed differently, and significant correlation between remotely sensed imagery and yield maps has been established. The owners/operators of the farm used in this study have begun to manage their operation based on this zone approach. Further work will examine the incorporation of all facets of geospatial technology into a farming operation. Other investigators are evaluating the cost effectiveness of this approach. The amendments used in the golf course industry in green construction were shown to be highly heterogeneous with regard to mineralogy, and subsequently, with regard to pesticide retention. It was believed that pesticide retention was due to both physical (entrapment of molecules) and ionic interaction. From a moisture release standpoint, when these amendments are mixed to an 80 (sand): 20 (amendment) mixtures by volume as is commonly done in green construction, these materials behave very similarly.

β. **Source of Federal Funds:** Hatch

χ. **Scope of Impact:** State Specific

Key Theme: Restoration and Best Management Practices (BMP)

a. **Statement:** Researchers at Auburn University are investigating distinctions between infertile soils (oligotrophic) and fertile, eutrophic soils in fertile flood plain forests in relation to the state's wetlands. Their studies are looking at both the productivity of these soils and systems and the biogeochemistry that affects them. Their investigations could reveal how these two types of ecosystems process nutrients and how nutrient circulation is linked to forest growth. This project began in October 1998 and will last approximately four more years.

α. **Impact:** Their research results indicate that moisture stress (i.e., deficits) may play a much larger role in controlling wetland productivity than previously thought. In the past, scientists have thought that too much water in wetlands can limit their productivity. Auburn research is suggesting, however, that dry weather and moisture deficits are more common and critical than previously thought. These results will provide a better understanding of why forest growth on those wetlands is lower.

β. **Source of Federal Funds:** Hatch

χ. **Scope of Impact:** State Specific

Key Theme - Soil Conservation, Quality and Bio-indicators

a. **Statement:** The object of this work was to generate basic knowledge on environmental remediation, specifically dealing with mechanism(s) of heavy metal adsorption/desorption/precipitation on soil mineral clay surfaces as affected by inorganic anions. Focusing on this objective, the nature of the interaction of Cr(VI), Pb(11), and Cu(11) with various clay mineral surfaces was investigated by Alabama A&M University scientists in conjunction with other laboratories. Studies on reaction of Cr(VI) with iron-rich clays indicated that structural Fe(II) in these surfaces is capable of reducing chromate to chromium (III). We found that Fe(II) either found naturally or produced by treatment of clay with sodium dithionate, effectively reduced Cr(VI) to Cr(III). This, in-situ remediation of chromium combines reduction of Cr(VI) to Cr(III) and immobilization of chromium on mineral surfaces. Our Pb sorption studies on clay surfaces indicated the Pb sorption on a kaolin surface to be a rapid and pH dependant process in which Pb sorption significantly increased with the amount of phosphate on the surface. Equilibrium sorption studies coupled with spectroscopic methods indicated formation of interlayer Pb surface precipitates on a smectite surface high Pb concentrations, and both pH and ionic strength of the media effected lead retention on this surface. X-ray absorption fine structure and Electron Paramagnetic Resonance spectroscopy were also employed to characterize the sorption of Cu(II) on silica surfaces at extremely low surface coverage (0.8 and 9.9% monolayer). We were able to show that a substantial fraction of the Cu(II) adsorbed at mineral surfaces was similar in structure to Cu(II) hydroxide clusters. Our research has shown that heavy metals during their interaction with colloidal surfaces in contaminated sites tend to form surface precipitates, which may be of mixed metal phase rather than being sorbed as individual mixed ionic species.

α. **Impact:** This research can have a positive impact on the cost effective clean up of heavy metal contaminated soil resources, ground and surface water as it affects individuals. Laboratories may use and further study the scientific knowledge gained here to refine and improve the technology inferred for best used in heavy metal clean up. Departments and institutions can extend the technology developed to other user groups and clientele in general.

β. **Source of Federal Funds:** USDA/DOE and Evans-Allen

χ. **Scope of Impact:** State Specific with AL, PA, WS, TX

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

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

Overview

One-fourth of the American population lives in rural areas. Alabama is 40% rural, based on 1990 census data. Further, the Black Belt Counties (BBCs) of South Central Alabama, which run from the Georgia border to the east, to the Mississippi border to the west, pose a unique challenge for the land grant system due to the demographical, social, and economical distinction of the region. For example, these counties are heavily rural, ranging from 36 to 100%, versus the national and state averages of 25 and 40%, respectively. The counties have a large non-white population, ranging from 44 to 86%, versus the national and state averages of 17 and 27%. The BBC poverty rate range of 20 to 39% is over twice the state average (19%) and over two and a half times the national average of 15%. The average annual unemployment rate ranges in the BBCs from 7.6 to 18%, versus the national average of 5.4% and the state average of 5.1%. In addition, the median income ranges from $14,000 to $24,000 versus the national and state averages of $31,000 and $26,000. Finally, the percent of high school graduates ranges from 49-62% in the BBCs, versus the state average of 67%. 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. Not only is there increasingly more reliance on technology for economic growth and job development, but also the nation is making transition of refocusing and retooling a significant amount of its technology to global and international competitiveness.

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 under development 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 population 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.

Alabama A&M University researchers have designed programs to ascertain the impact of technology and sustainable agriculture practices on the well-being of farmers, in 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 and be assisted by access to and participation in specific USDA programs. Further outcomes of the research under this goal will enable the forestry industry in the state to more effectively support rural development in the state and assist farmers in developing sustainable farming practices and other enterprises.

Inst.	FY 2000		FY 2001		FY 2002		FY 2003		FY 2004	
	Approximate Expenditures	SY	Projected Expenditures	SY	Projected Expenditures	SY	Projected Expenditures	SY	Projected Expenditures	SY
1862 (AL)	1,218,759	5	1,294,510	3	1,359,236	3	1,427,197	3	1,498,557	3
1890 (ALAX)	135,110	1	383,670	2	402,853	2	422,995	2	444,144	2
1890 (ALX)	505,304	3	286,819	3	301,159	3	316,216	3	332,026	3
Totals	1,859,173	9	1,964,999	8	2,063,248	8	2,166,408	8	2,274,727	8

Allocated Resources ($) and Scientists Years (SY).

Key Theme: Economic Viability and Sustainable Communities

a. **Statement:** The Black-Belt Region of Alabama is of great potential both in terms of physical and human resources, yet, income and quality of life disparities are tremendous for the people and the communities from within and compared to other rural areas. These inequities will remain as long as problems of economic growth are not aggressively addressed. Research at Tuskegee University is therefore assessing the impact of socioeconomic factors on sustainability of agriculture in the Black Belt for limited-resource farmers.

α. **Impact**: Descriptive statistics found that the age of the farmers in the study ranged from 34 to 88. The median age was 62. The mean level of formal education was 11 years. In general, elderly farmers had received less formal education than their younger counterparts. The combination of high age and low education suggests an impact on adoption of innovations as well as illustrating the out migration of younger, higher educated people from rural areas and farming. Only seven of the 40 farmers surveyed had value added enterprises. Income from these operations ranged from $580 to $12,364. Average income from value added enterprises was $3,159. Nearly all of the farmers in the study had off farm income including retirement, disability payments, and full-time, part-time and self-employment. Yearly off farm income ranged from $0 to $80,000. A statistical model was developed to assess the impact of age, education, value added enterprises, and off farm income on the sustainability (as measured by net farm income) of limited resource farmers. The results of regression analysis indicated that only off farm income had a significant effect on farm sustainability. According to the analysis, a $1 increase in off farm income results in a $.23 increase in net farm income. Analysis of socio-economic data indicated that 4 Black Belt counties (Bullock, Butler, Lowndes, Macon) are the least developed counties in Southeast Alabama.

β. **Sources of Federal Funds:** Evans-Allen

χ. **Scope of Impact:** State Specific

a. **Statement:** Auburn University research has focused on natural resource and environmental issues in rural areas. Most recently, the researchers have focused on the issue of "resource dependency," the tendency for rural communities to become closely linked to a single source of employment and income, such as forestry. Reliance on a single industry leads to potentially serious problems of vulnerability. The researchers

have documented the nature of this vulnerability for different population groups (e.g., by race and gender), examined land ownership patterns in forestry, examined the connections between local landowners and the out-of-state corporations that dominate the forestry sector, and examined ecosystem impacts at the landscape level of expanded timber production in Alabama (e.g., the impact of expanded loblolly pine plantations).

α. **Impact:** The intent of the research is to document the advantages gained by forest products industry firms operating in Alabama, and to help the industry identify ways in which they can, in turn, contribute more effectively to rural development in the state.

β. **Source of Federal Funds:** Hatch

χ. **Scope of Impact:** State Specific

Key Theme: Small and Family Farm

a. **Statement:** A study was done by Alabama A&M University researchers with regard to the impact of sustainable agricultural practices and technologies on the well-being of small farmers in north Alabama. Personal contacts and telephone interviews with agricultural teachers, extension personnel, and primary change agents in technology transfer were used to solicit information about the knowledge and understanding of stakeholder groups regarding sustainable agricultural practices and the effectiveness of different information delivery systems. These contacts showed that they have adequate knowledge and positive attitudes toward agriculture sustainability. However, there were significant differences between location within the state, age, years of experience, ethnicity and prior association with the technology.

α. **Impact:** This study will provide environmental, economic and educational information to small and limited resource farmers about sustainable practices and marketing strategies for alternative enterprises.

β. **Source of Federal Funds:** Evans-Allen

χ. **Scope of Impact:** State Specific

a. **Statement:** Despite the poverty endemic to the Black-Belt region in Alabama, forests are one of the major natural resources available in this region. Non-industrial private forestland owners including minority and limited-resource farmers control most of these forestlands in these counties. The forestland owned by socially disadvantaged farmers ranged from a few acres to more than 500 acres. These forestlands have not significantly contributed to the household income of small forestland owners mainly due to lack of sustainable management practices. Research at Tuskegee University is therefore aimed at identifying the constraints of and opportunities for small forestland owners and assessing the potential of forestry for improving income and employment.

α. **Impact:** One hundred and eighty-two minority landowners were surveyed. According to the survey results, the size of the forestland held by these landowners was relatively small, most less than 100 acres. Most of the forests owned by these landowners were mixed pine and hardwood. The top ranked ownership objectives were investment, wildlife/hunting, fuel wood and recreation/fun. Tree planting, cattle grazing, and natural regeneration dominated management practices used by the respondents. Many of these landowners had thinned or harvested their forests, but the forestland had not significantly contributed to their income. The lack of capital, labor and knowledge of forest management and marketing impeded the landowners from generating more benefits from

their forestland. About two-thirds of the landowners were willing to participate in a technical assistance program. In addition to the landowner surveys, the scientists were actively engaged in technical assistance. Brochures and related materials were mailed to the landowners who were willing to participate in technical assistance. Landowners were informed of available workshops and training programs. During the annual Farmers Conference at Tuskegee University, the researchers co-sponsored a forestry field trip to expose the participating farmers/landowners to economic opportunities in forestry. They also provided referring services for landowners to locate appropriate public and private assistance sources.

β. **Sources of Federal Funds:** Evans-Allen

χ. **Scope of Impact:** State Specific

Key Theme: Families and Children

a. **Statement:** An Auburn University project is identifying issues that affect the stability of marriages and families. Researchers are interviewing young married couples about their allocations of housework and the processes they have used to arrive at these decisions. They also are also asking these couples to keep daily records for a period of several weeks to obtain detailed information about what is actually happening in these couples day by day. These periods of data collection are to occur once each year for the period of the project (four years).

α. **Impact:** With the information collected, the researchers will be able to see patterns of consistency and change in couples, and also understand how changes in couples lives – such as becoming parents or changing jobs -- are associated first with their allocations of housework but more generally with the quality of their personal relationship.

β. **Source of Federal Funds:** Hatch

χ. **Scope of Impact:** State Specific

a. **Statement:** The ultimate success of a commodity product such as cotton largely depends on the ability of manufacturers and others in the apparel/textile pipeline to provide value-added by using this fiber to design and sell finished clothing and textiles products that successfully compete in the "marketplace of taste." The development of an online research tool provides producers and retailers with rapid-response feedback to changing consumer tastes so that cotton-based products can retain a competitive advantage in the domestic and international marketplace.

α. **Impact:** Auburn University researchers have developed software required to conduct a new form of online research to collect pilot data from consumers regarding their preferences for actual clothing and home furnishings products. A demo website is available for viewing at

http://www.fafnir.berry.edu/ConsumersOnLine/index.html.

a. **Source of Federal Funds:** Hatch

α. **Scope of Impact:** State Specific

Stakeholder Input

Stakeholder input into the planning and priority setting of Alabama's Agricultural Research Programs (AARP) is both continuous and include 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 policy makers. Additionally, input is sought through the Annual Farmers' Conference, the Professional Agricultural Workers Conference, the Annual Agriculture Week, Advisory Councils, and the five Research and Extension Centers throughout the state in conjunction with the Alabama Cooperative Extension System (ACES) including the Tuskegee University Extension Program. Furthermore, the Director of the Alabama Agricultural Experiment Station (AAES) has appointed a Faculty / Industry Council which meets periodically throughout the year to address issues of agricultural concern. The role of the Council is to advise the Director with regard to priorities which are used to formulate future plans for the AAES. Farmers and other key constituent groups have input via their respective associations/commodity groups. The Associate Directors of the AAES (including selected associated academic schools 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.

In addition to the stakeholder-input mechanisms described above, the Director of AAES established a Futuring Task Force (FTF) made up a Steering committee which of literally seeks input from hundreds of stakeholders around the state. These individuals will identify opportunities that will be available to the State's agroindustrial complex to the year 2025 and discuss and recommend programmatic directions for the AAES as well as provide evaluation and assessment of current programs.

a.**.**

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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 – p5).

The Director of the Experiment Station and other Administrators ensure that projects/programs are merit reviewed and that they adhere to criteria listed in the Administrative Manual for the Hatch Act as amended as well as the Handbook for Research Project Leaders for the Alabama Agricultural Experiment Station.

Evaluation of the Successes of Multi- and Joint- Activities

The Alabama Agricultural Experiment Station (AAES) participates in approximately 38 multi-state projects. These projects meet the 25% or more requirements for formula funds in multi- and joint project with a total dollar amount of $8,823,636. The research conducted in these projects covers the five state programs identified in the Alabama Five-Year Plan of Work under the

various REE goals. AAES researchers participate in 22 projects in the Southern Region, 5 projects in the North Central Region, 4 projects in the Northeastern Region and 7 projects in the Western Region.

All of the multi-state projects address critical issues that were identified through a variety of stakeholder input processes, such as Annual Farmer's Conference, the Professional Agricultural Workers Conference, Advisory Councils, Commodity group meetings, and with the five Research and Extension Centers throughout the state in conjunction with the Alabama Cooperative Extension System including Tuskegee University Extension Program. Also included in the stakeholder input process is the Associate Director of the AAES and the Research Directors at Alabama A&M and Tuskegee University and their advisory councils. The various stakeholder input aides in identifying and addressing the needs of the under-served and under-represented populations in the state.

Some highlighted multi-state projects are "Integrated management of arthropod pest of livestock and poultry", "Mineralogical controls on colloid dispersion and solid phase speciation of soil contaminants, "Genetic maps of aquaculture species", "Weed control in nursery and landscape crops", "Avian respiratory diseases; pathogenesis, surveillance, diagnosis and control", A holistic approach to enhance water quality and reduce non-point pollution", "Rural restructuring", "Evaluation of international markets for southern commodities" and "Enhancing food safety through food borne disease agents". Due to the large number of multi-state projects and the diversity of their subject matter, the specifics of each program cannot be addressed in this document. However, the importance of these projects in allowing for research activities to take place across state lines with many researchers addressing the objectives of each project provides a more rapid avenue for problem solving. This in turn results in outcomes that more quickly and efficiently meet the needs of the citizens of the state.

Multi-state Extension Activities

These activities will be covered under the Five-Year Plan of Work from the Alabama Cooperative Extension System.

Integrated Research and Extension Activities

These activities will be covered 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 2000:

3/7/01
Date

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

3/8/01
Date

Dr. Luther Waters
Dean and Director
College of Agriculture, and
Alabama Agricultural Experiment Station
Auburn University

3/9/01
Date

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