ANNUAL REPORT OF ACCOMPLISHMENTS

Alabama Agricultural Research Programs

(AARP)

at the

Alabama Agricultural Experiment Station
(Auburn University)

and

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

and

The George Washington Carver Agricultural Experiment Station
(Tuskegee University)

for

Federal Fiscal Year

2001

October 1, 2000 – September 30, 2001

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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. These offices, located on each campus, 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 2001 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:

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

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

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

POINTS of CONTACT: This plan is jointly submitted by: *Dr. John Jensen* (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 John Jensen, who is providing leadership in this effort.

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Adoptions by Reference:

- Alabama Agricultural Research Plan for the 21st Century
- Programs School of Agricultural and Environmental Sciences
- Handbook for Research Project Leaders for the Alabama Agricultural Experiment Station
- Administrative Manual for Evans-Allen Cooperative Agricultural Research-Project Approval

·Globalizing Agricultural Science and Education Programs for America (GASEPA)

ANNUAL REPORT OF ACCOMPLISHMENTS AND RESULTS

PLANNED PROGRAMS

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. Still 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 ($)	SY	Approximate Expenditures ($)	SY	Projected Expenditures	SY	Projected Expenditures ($)	SY	Projected Expenditures ($)	SY
1862 (AL)	15,411,148	56	13,957,013	42	14,654,863	42	15,378,606	42	16,156,987	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	14,918846	56	16,220,501	56	17,837,105	56	18,738,410	56

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

Key Theme: Value-added Foods

Statement: At Tuskegee University, studies continue on the development of novel functional food. Pursalane and sweetpotato greens were evaluated for their phytosterol content and as functional food sources. Phytochemicals in these foods are known to reduce blood cholesterol levels and decrease overall heart disease risk. Previous sensory research analysis has shown that these novel vegetables are generally accepted in the diet. Incorporation of such novel functional foods in diets of at-risk communities will assist in the reduction of heart disease and increase in the nutritional well being of the targeted underserved communities.

Statement: Many variables influence how long food lasts. Ingredients in food can change over time, which may cause the food to taste bad, look bad, or be less nutritious. Understanding the variables that influence these changes can help scientists find better ways to make foods last longer while maintaining their nutritional value. An Auburn University project is improving the quality and nutritional value of foods by exploring ways to control chemical reactions. Already the research has shown that the physical structure of foods influences chemical reactions. Pores in food appear to be sites for chemical reactions, so product stability is increased by the elimination of pores in food products. The work also has shown that a phosphate buffer promotes numerous chemical

reactions in comparison to citrate buffer, so switching buffer types may improve food quality and stability.

Key Theme: Economics

Statement: Some risk is inherent in all sectors of agricultural production. Auburn University researchers are evaluating and identifying predictable risks for various sectors of agriculture. The results of these studies will help describe more fully the potential gains and losses that can be expected from engaging in various agricultural enterprises. Already scientists have identified which types of aeration are better for catfish culture in the Piedmont region, which should help producers increase yields and net returns. They also analyzed the impact of certain policy alternatives on peanut farmers. This has helped correct some legislators' misconceptions of the effects of policy interventions, and prevented some errors in estimating whose earnings will be affected and by how much.

Key Theme: Improved Crop Systems

Statement: The peanut is an economically important crop in the state of Alabama and southeastern United States. In an effort to increase the efficiency of peanut production through the use of resistant cultivars scientists at Tuskegee University are employing biotechnological approaches. The goal is to identify DNA markers linked to disease resistant genes and to locate these markers on a genetic map. Inbred lines resistant to late leaf spot and leaf rust were used to construct the genetic map. Nine hundred AFLP primer pairs were used to identify polymorphic markers between two parents. Out of the 400 polymorphic DNA markers detected, 45 were mapped on the genetic map. None of the AFLP markers has yet been linked to the resistance genes. Studies are still in progress. Identification of genetic markers linked to resistance genes will be very useful in marker-assistant selection and map-based clones.

Statement: Research has proven that soyfoods and soybean components attribute significantly to a healthy diet. Alabama A&M University scientists are looking closely at the genetics of valuable food crops such as soyfoods and soybeans in order to increase production and quality. The AAUM scientists are investigating the linkage relationships among molecular markers generated with gene specific and non-specific primers found in soybean. 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 five linkage groups and 13 marker loci were unlinked. 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. Further studies are continuing to understand how the viral sequence was integrated into the soybean genome. Plant breeders are now able to select the high yielding soybean cultivars, thus increasing farmers' incomes and

maintaining low cost soybean products, due to increased availability - creating benefits for the farmers and consumers.

S**tatement:** Cotton is a principle textile fiber and a prominent oil crop in Alabama and the United States. Reniform nematode is a little-studied pest for which there is no known resistance in cultivated cotton. Genetic engineering offers the only current hope for overcoming this actively spreading pest. Root cultures offer the most consistent and economical means for evaluating Reniform resistance without resorting to field tests, and are being used by Alabama A&M scientists to address the challenge to cotton production as effected by Reniform nematodes. Single nematode DNA has proven to be amplifiable using gel-based markers. Protocols for amplification using fluorescent-labeled primers and analysis by capillary electrophoresis are being tested.

Statement: The impact of supplemental honey bees on cotton production was studied at Alabama A&M University with the hypothesis that cotton production, as indicated by the number and size of mature bolls, lint, and seed weights, will decrease with increasing distance from the bee colonies. These indicators are also related to the level of foraging activity of honey bees. Results consistently showed he positive impact of honey bees on cotton production: a significant negative correlation was detected between weights of bolls, lint, and seeds and distance form the bee hives. The eradication of boll weevil and the use of transgenic Bt cotton varieties have made the establishment and maintenance of pollinator populations, particularly honey bees, in cotton-producing areas possible. The introduction of supplemental honey bees in cotton production fields is mutually beneficial to cotton growers and beekeepers. Additionally, more revenues could be potentially gained by beekeepers by maintaining honey bee pollinators for hire.

Statement: Watermelon is an important vegetable crop in Alabama. Almost 20% of the 85,000 acres of land in Alabama used for vegetable production are devoted to watermelon. An important aspect of successful production is the control of diseases that reduce productivity, quality, and profitability. Endogenous plant resistance may not always be available but fortunately becomes more achievable through biotechnology. This will require extensive genome mapping and molecular identification and "cloning" of disease resistance genes. Auburn University researchers are conducting genetic evaluations of watermelon to develop genetic maps, which will enhance the selection and development of multiple disease and insect resistant plants that produce high yields of high quality watermelons. This would save money for watermelon producers and provide environmentally safe pest control.

Statement: Minor horticultural crops, such as landscape and nursery crops, often need chemical treatment to protect them from a wide range of pests. However, many chemical companies with products that may be useful for this process do not have the time or resources to collect the data necessary for these chemicals to broaden their labels. Auburn University researchers are part of a national cooperative program called IR-4 Research Program that is evaluating pesticides for use in minor crops throughout the U.S. To date this work has led to the expansion of many pesticide label registrations. These new minor crop registrations give producers more control options, which in turn can lead

to increased productivity. Since 1997 the group nationwide has obtained 1,192 herbicide registrations for minor horticultural crops.

Key Theme: Improved Poultry Systems

Statement: Improved control of economically important diseases of commercial poultry will lead to cheaper cost of production, which will ultimately lead to lower costs for consumers of poultry products at the supermarket. Over the past 25 years Auburn researchers have developed and/or tested most of the vaccines and detection methods for the control and diagnosis of infectious bursal disease viruses and reovirus infections of chickens. Improved detection and prevention of these viruses saved money for poultry producers and consumers alike.

Statement: Auburn researchers are studying the genes of meat producing birds to determine which genes influence disease resistance in chickens. In the past, virtually all work of this sort had been done in egg-laying (Leghorn) chickens. Using antibody-based and molecular biological methods to characterize the MHC genes in broiler (meat-type) chickens, researchers developed reliable methods to identify many variant forms (alleles) of these genes in meat-type chickens. They have since collaborated with other investigators to test whether particular MHC genes confer resistance or susceptibility to economically important infectious diseases in chickens. Results show that commercial meat-type chicken lines have many variant forms of MHC genes, some of which are the same as egg-laying chickens and some of which are different. A primary broiler breeder company already has used this AU information to make their lines more resistant genetically to Marek's disease. With more knowledge, future vaccines may be designed to work optimally with the MHC alleles that are present in a line. All this may lead to lower costs for consumers and healthier chickens. This laboratory is the only one in the world that has the reagents and the genetic stock to do this kind of work in meat-type chickens.

Key Theme: Improved Animal Systems

Statement: In an effort to continue to support the fast growing goat industry in Alabama, scientists at Tuskegee University continue their research on developing diet formulations for goat feed. Goats were fed diets containing different levels of yeast culture as a feed additive to determine intake, apparent digestibility, and ruminal fermentation patterns in goats. Results show that goats fed up to 30g/day of yeast culture had higher dry matter intake and digestibility. Fiber digestion was increased and nitrogen balance was improved when animals received yeast culture supplemented diet. Feeding additives such as yeast culture or a feed supplement such as Cu have beneficial effects on diet digestibility animal performance, which translates into more efficient and profitable production.

Statement: The horn fly (*Haematobia irritans irritans*) is a major insect pest in Alabama and many other parts of the world. Adult flies of both sexes take blood frequently from cattle and other livestock, causing losses in meat and milk production and also damaging

hides by transmitting *Stephanofilaria stilesi*, a nematode skin parasite. The economic impact by this fly on livestock production in Alabama is in the tens of millions and in North America approaches one billion dollars per year. Control is difficult because of wide-spread tolerance to most kinds of insecticides and the fly's ability to develop resistance rapidly to new products. Researchers at Auburn University are developing a vaccine that targets factors in the fly's saliva that enable the fly to take blood. If successful, this vaccine will prevent blood-feeding on cattle by adult horn flies, and thereby deprive these insects of the nourishment needed for maintenance and reproduction. Studies are currently underway to determine if vaccination with a recombinant form of this important molecule can stimulate the formation of specific neutralizing antibodies to thrombostasin and if blood-feeding on an immunized animal can affect the amount of blood ingested. If successful, this approach is entirely unique and could eventually save livestock producers millions of dollars and eliminate the use of insecticides for horn fly control.

Statement: The effects that diseases have on endocrine function (growth and reproduction) and the use of hormones to assist animals through disease processes are being studied at Auburn University. This information could improve animal productivity by reducing the impact of disease on growth and reproduction. In one project, researchers determined the mechanisms that endotoxemia stimulates growth hormone release and a portion of the mechanism for luteinizing hormone inhibition by disease. A second project found that anabolic hormones delay the onset of disease symptoms and enhance the rate of recovery from disease. In coccidiosis, there is a positive weight gain in anabolic treated calves versus a loss of body weight in calves not protected by the anabolic agents. These data provide a means of directly improving productivity in cattle.

Key Theme: Development of Alternative Specialty Crops

Statement: 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. Alabama A&M University conducted several tours and/or demonstrations with more than 500 participants. Several farmers have adopted techniques employed in this project.

Statement: Twenty-two canola genotypes and plant introductions (PIs) were used as parents to develop new winter-type canola lines for the mid-south. Twenty-nine combinations of crosses were made among the selected parents with greater than 60% seed-set achieved in successful crosses. A significant finding was made in the canola plots at the Winfred Thomas Agricultural Research Station at Alabama A&M University during post harvest scouting of canola stalks for insect damage (June 2001). The stem-boring insect, clover stem borer, *Laguria mozardi Latreille* was discovered in the pith of several of the canola cultivars being evaluated. This is a new pest for canola, thereby spurring several experiments to study the impact of this new pest. The discovery of a new pest (clover stem borer) in canola is a significant find that will require further work towards producing new cultivars. Researchers at Alabama A&M University are

designing new field and greenhouse experiments to study its impact on canola production.

Statement: Velvetbean, a legume crop once grown extensively in Alabama during the early 1900s, may be experiencing a rebirth in sustainable farming systems. Velvetbean can help control nematodes, boost soil quality and nutrients, and may even offer a new cash crop or source of livestock feed for some farmers. Auburn University researchers are some of the few scientists in the world working with genetics and biosystematics of velvetbean on both a phenotypic and molecular level. Identification of the best velvetbean genotypes for production in Alabama will provide farmers with an alternative cover or forage crop that also has potential for pest management and provide a legume crop that can be a part of a sustainable system with few or no chemical inputs. Crop studies using velvetbean in rotation with other crops showed as high as a 76.5% increase in yields per acre for soybeans in nematode infested fields. Velvetbean rotations also significantly increased yields of cotton and peanuts. Interest in velvetbean as a rotational and cash crop is increasing More velvetbeans were grown in Alabama in the last five years than in the last 40 years. SARE also is funding some on-farm projects and some 30 farmers are growing velvetbean on a trial basis.

Key Theme: Fisheries and Aquaculture

Statement: Oyster reefs are the basis of commercially valuable fisheries, are habitat for a host of organisms that support recreationally and commercially important species, and provide a significant filtration of algae and other particles in nutrient rich estuaries. These functions have been lost at a number of oyster reefs that are no longer viable. Auburn University research is determining the factors that keep these reefs from being productive and seeking practical solutions to restoring these reefs including the use of hatchery produced oysters and volunteers to grow juvenile oyster for stocking. Results to date suggest that periodic low oxygen events prevent reestablishment of some reefs and sedimentation may be a further contributing factor. Experiments to overcome these factors will result in recommendations for restoring specific reefs at specific sites. Hatchery produced seed oysters (spat) may supplement natural recruitment at some sites. Spat set on shell has a higher survival rate than clutchless spat and is cheaper to produce. There is no advantage to stocking larger spat when survival and cost are considered together. Significant savings can be made by using smaller, less expensive spat for reef restoration/enhancement.

Statement: Alabama has one of the highest diversity of fish populations in North America. The Mobile Bay basin alone has 41 endemic species; the entire state has 61. The vast majority (90%) of Alabama fish diversity is comprised of non-game species; more than 50% of these species are minnows (*Cyprinidae*) and darters (*Percidae*). Unfortunately, virtually no information on the biology of many of these animals exists. Information on life history and ecology is entirely lacking for numerous species, many of which are imperiled. Loss of this tremendous biodiversity would have profound ecological and economic consequences. Auburn University researchers are monitoring populations and studying movements and spawning behaviors in a variety of non-game

fish species. They also are using audio equipment to learn if the fish actually make sounds to establish territories and aid in mating. This work is finding new insights into the conservation of fish species. The work with fish migration and movement will lead to a better understanding of recolonization dynamics and will assist in the development of realistic management plans. The projects also have revealed vital information about the movement of various species, noting that many fish stay in a very contained area of a waterway. This can lead to ways to protect habitats where fishes are sedentary have little chance to escape environmental changes and hazards. The discovery of sound production in various species changes the way researchers view the sensory world of these organisms and may lead to new explanations for behavior and ecology patterns in these groups.

Key Theme: Water Quality

Statement: Livestock activities associated with unmanaged stocking systems have heavily damaged the vegetation and soil of many riparian areas close to grazed pastures. Total exclusion of cattle through fencing is not a sustainable remedy in the southeastern U.S. Auburn University research is evaluating the potential effectiveness of rotational stocking systems to improve productivity and utilization of desirable forages, reduce grazing animal activity in riparian areas and streams, allow recovery of riparian vegetation, and improve stream water quality.

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

Statement: Technologies are available to convert grasses, such as switchgrass and other perennials, to electricity and liquid fuels, such as ethanol. Many grasses can also be used as a substitute for hardwood to produce high quality paper. Auburn University research is aimed at developing these crops and technologies so that producers and the nation can reap the associated benefits. To date the project has developed optimal production practices for use of switchgrass as an energy crop, and work has started on evaluating a range of common forage grasses for both energy and paper production. The result will be a more viable rural economy.

Statement: The development of social-emotional competence in childhood is the single best predictor of individuals' success in school and their future contributions as productive members of the work force. The two most important influences on social-emotional competence during early childhood are the family and childcare experiences. For children from low income families who at risk for academic failure and problem behavior, good quality early child care significantly reduces later problems. An Auburn University study is examining family and childcare factors that are associated with children's social and academic competence, and physical health. The information produced by this project provides guidelines for parents, educators, and policy makers on how we can maximize children's adjustment and competence, and ensure that every child enters school ready to learn. The findings from this project are reported in professional journals and conferences, and in magazines for parents (e.g., *Parents' Magazine, Sesame*

Street Parents' Magazine), and provide a basis for Cooperative Extension programs focused on parent education and child care quality improvement.

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

Key Theme: International Collaborations

Statement: Agriculture in developing tropical countries is in crisis because increased populations and bad land husbandry practices are leading to land degradation and loss of productivity. Alley cropping, an agroforestry practice designed to sustain crop production while restoring organic matter and nitrogen to the soil, is one possible management technique for highly erodible lands. Auburn University researchers are exploring ways to adapt alley cropping to different growing conditions in countries like Haiti and Brazil. Results so far show that alley cropping is more effective than rock wall terraces, contour canals, or grass rows at sustaining crop yields. Alley cropping also reduces sediment loss and runoff from plots. Applications of leaves and stems from hedgerows to the soil double corn yield and that pruning three times per season increases yield by 50%. This group is the only research team exploring the use of alley cropping for soil erosion control in the Southeast and possibly in the world.

Statement: Aquaculture is a thriving industry in the United States and in other nations. However, it can produce adverse environmental effects. Auburn University researchers are looking at aquaculture at the state, national, and international level. Projects on pond soils sponsored by the USAID PD/A CRSP project are being conducted in South Africa, Brazil, and Thailand. Results of these studies will provide better pond soil management procedures for improving environmental quality in production systems and enhancing pond effluent quality.

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 anti-microbial 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	Approximate Expenditures	SY	Projected Expenditures	SY	Projected Expenditures	SY	Projected Expenditures	SY
1862 (AL)	4,837,516	23	3,928,689	13	4,112,123	13	4,331,380	13	4,547,948	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	4,285,525	17	4,486,800	17	4,724,790	17	4,838,768	17

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

Key Theme: Food Safety – Animal Products

Statement: Scientists at Tuskegee University continue to develop methodology to make meat and eggs safer from microbial pathogens by using natural anti-microbial agents. Earlier studies on laboratory media provided evidence that when used in combination with chelators, lysozyme, lactoferricin-B, and bacteriocin nisin are effective in reducing populations of gram negative bacteria. Studies were therefore initiated using ground beef as a model food system. Results indicate that unlike the laboratory media, the effectiveness of nisin, lactoferricin-B, and lysozyme against *E. coli* 0157:H7 is substantially reduced. Further work is in progress to enhance the effectiveness of these anti-microbial chelators.

Statement: Enterohemorrhagic *E. coli* O157:H7 is an emerging food-borne pathogen. Fecal shedding of the pathogen by ruminants is the mode of entry into the human food chain. Since diet is a major determinant of intestinal microflora, the potential exists to reduce *E. coli* O157:H7 shedding by ruminants through pre-harvest dietary intervention. Researchers at AAMU studied the effect of dietary acid-detergent fiber (ADF) concentration on fecal shedding of *E. coli* O157:H7 in lambs. The results indicated that regular all-concentrate diets, when fed to lambs as the sole nutrient source, increase fecal shedding of the pathogen. By increasing the ADF content of the concentrate diet between 10 and 20%, shedding of the pathogen can be minimized without adversely affecting meat production efficiency. Reduction in fecal shedding of the pathogen should result in reduction in contamination of food items and losses associated with the disease.

Key Theme: Food Safety – Fruits and Vegetables

Statement: Finding alternatives to traditional insecticides to control insect pests would benefit not only the environment, but also make fresh fruits and vegetables even safer and healthier for human consumption. Auburn University researchers are exploring the effectiveness and safety factor of the bacteria *Bacillus thuringiensis* (Bt), a naturally occurring substance the kills many destructive caterpillar pests. Auburn scientists are helping determine the likelihood of insects developing resistance to transgenic plants that contain these proteins. Their lab has the only beet armyworm colony in the world that is resistant to Bt, and the only known colony resistant to the type of protein found in Bt transgenic plants. Results of their studies show that resistance to a Bt protein does not necessarily translate into cross resistance to Bt formulations. This is important because organic farmers can now feel safer about using Bt transgenic plants and Bt. The research also has led to the development of a model documenting the highest level of foreign gene expression in plants using Bt to control insect pests and a patent for this model has been submitted.

Key Theme: Genetic/Biochemical Modification of Foods

Statement: Wholesome and safe muscle foods are an excellent, highly available source of critical nutrients, including essential amino acids and B complex vitamins and folic acid among others, for humankind. A negative aspect to muscle foods is that these food products may contain too much fat. Auburn University researchers are applying genome and transcriptome analysis of the fattening process in meat animals to find such new strategies. A full understanding of the biochemistry and metabolic regulation involved in fattening in meat animals allows us to devise sustainable, animal- and producer-friendly approaches to enhance the efficiency of production of muscle foods that are highly nutritious and serve as an important component of the human diet. The AU laboratory was largely responsible for describing the mechanism of biochemical action of a currently used feed additive in swine diets (PAYLEAN/ Elanco) that lowers fattening and enhances muscle growth in pigs. The uniqueness of this work lies in the fact that this level of understanding of regulation of fattening can be exploited to develop practical means of lowering fattening in pigs. They are expanding this to obtain a more comprehensive view of regulation of fattening in pigs.

Key Theme - Food Safety and Risk Analysis

Statement: Increasing food production security from farm to fork and prevent agroterrorism attacks on the United States. Auburn University researchers are working on these issues. One project is helping identify the cause of avian cellulitis, which is a poultry skin disease that costs the poultry industry and consumers $80 million per year. The research has revealed ways of preventing the disease and dealing with the disease should it occur. This in turn has dramatically lowered the cost of the disease, the savings of which have then been passed onto the consumer, ensuring the continued availability of a safe and economical product.

Goal 3: A Healthy, Well Nourished Population

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

Overview

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

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

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

Scientists at Auburn University are conducting research that evaluates the nutrition 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-3 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	Approximate Expenditures	SY	Projected Expenditures	SY	Projected Expenditures	SY	Projected Expenditures	SY
1862 (AL)	2,227,188	4	1,977,742	10	2,222,355	10	2,333,769	10	2,187,410	10
1890 (ALAX)	134,150	1.2	140,017	1	147,017	1	154,367	1	162,085	1
1890 (ALX)	164,785	1	174,439	2	183,160	2	192,318	2	201,933	2
Totals	2,526,123	6.2	2,292,198	13	2,579,532	13	2,680,454	13	2,551,428	13

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

Key Theme: Nutrient Composition of Foods and Nutrition Education

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

Key Theme - Diet Modification for Targeted Populations

Statement: DHA (docosahexaenoic acid) is a dietary essential omega-3 fatty acid that is important in visual and neural development of infants. It is important that an adequate supply of DHA be provided in the diet of pregnant and lactating women and in infant formula given to bottle-fed babies. The major source of DHA in traditional diets is cold water marine fish, which is not consumed daily by the American population. Therefore, it is important that novel sources of DHA be found for pregnant and lactating women and for bottle-fed infants. Auburn University researchers explored new ways of adding essential fatty acids to the diets of new born infants and lactating women. In February 2002, the first infant formula containing DHA and ARA was introduced in the United States. Research conducted at Auburn University contributed to the FDA approval of the addition of these fatty acids to infant formula. Lactating women who do not consume adequate amounts of high DHA fish may also benefit from research conducted at Auburn University. A novel approach to increasing omega-3 fatty acids, such as DHA, in the U.S. food supply is to feed animals a source of omega-3 fatty acids, which in turn becomes part of the animal food products they produce. For example, hens fed a source of DHA lay "designer" eggs enriched in DHA. When these "designer" eggs are consumed by nursing mothers, the infant receives greater amounts of DHA during the crucial developmental period. In one AU experiment, the content of DHA in breast milk was increased 2.5 times that of baseline when lactating women consumed daily two "designer" eggs.

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 wastes 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, and 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	Approximate Expenditures	SY	Projected Expenditures	SY	Projected Expenditures	SY	Projected Expenditures	SY
1862 (AL)	12,538,179	36	11,825,926	38	12,417,222	38	13,038,083	38	13,689,988	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	12,186,950	41	12,796,296	41	13,436,109	41	14,107,916	41

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

Key Theme: Water Quality and Waste Management

Statement: Agricultural lands have been used as an inexpensive solution to the disposal of broiler litter in Alabama. Tuskegee University scientists have focused their research on addressing the environmental concerns of ground water pollution and long-term effects on the agricultural ecosystems of broiler litter applications to agricultural lands. Earlier studies identified the presence of 19 trace elements in broiler litter in 33 broiler litter producing sites sampled in Alabama. Current studies are therefore focused on the effects and fate of these trace elements on nitrogen transformation in the soils. Results thus far indicate that nitrification rates varied from soil to soil.

Statement: Solvents used in dry cleaning operations and as degreasers in industry and the military are suspected carcinogens. They don't mix with water and have a much greater density. Their behavior in soil and groundwater is, therefore, often difficult to predict. Although they don't mix with groundwater, they slowly dissolve and exist as sources of pollution for many years. Auburn University research is characterizing their behavior in soils and groundwater following spills and also is investigate cleaning up methods for contaminated regions, especially with the use of surfactants. The latter increase the solubility and mobility of solvents. They have developed computer model validation information that helps predict the behavior of solvents in soils and groundwater. Their results are presently being used by the Civil Engineering Department at the University of Michigan and at the Pacific Northwest National Laboratory in Richland, Washington.

Statement: Managing animal manures is a challenge for agriculture. Manures contain nutrients that can be beneficial to crops and soils, but also can pollute water systems. Auburn University researchers are developing, evaluating, and refining physical, chemical, and biological treatment processes in engineered and natural systems for management of animal manures and other agricultural wastes. The project began in October 2001, so no results are yet available. However, results may allow livestock and poultry producers to find better ways of handling animal waste.

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Key Theme: Soil Conservation

Statement: Scientists at Tuskegee University continue to focus on methods of controlling soil erosion to ensure sustainable agricultural production on small limited resource farms. Previous studies have shown that eastern gamagrass (*Tripsacum dactyloides*) grown as grass hedge to control erosion can be incorporated in a farming system of a small scale farm. Current studies are focused on adaptability of several eastern gamagrass to several acid soil types from in the southeastern U.S. Preliminary results indicate that eastern gamagrass performed favorably across soil types and pH levels studied.

Statement: Long-term fertility/soil test calibration experiments provide a rich source of information on soil changes over time. Auburn University has maintained and monitored such long-term experiments at eight Alabama locations, and these experiments are providing the basis for a southern regional effort through SERA-IEG-6 on Soil Testing and Plant Analysis to document research-based soil test calibration and recommendations for cotton on Coastal Plain soils. A regional publication is forthcoming.

Key Theme: Urban Issues and the Environment

Statement: Fire ants are found in every county in Alabama and affect the lives of every household. Recent studies estimated the annuals losses to households in Alabama to be over $175 million dollars. These estimates are only for households and do not reflect other affected entities such as agriculture, businesses, airports, golf courses, schools, utilities, and others. Auburn University researchers are exploring ways to control and manage these pests. Results so far have shown that targeted treatment of fire ant hills is a cheaper and more effective way to manage fire ants in many settings. Populations in one treated area were reduced by 90% and were maintained at that level during four years of the demonstration. Phorid flies, natural enemies of fire ants in South America, also have been established in Macon, Houston, and Lowndes counties. Possible benefits may be reduced application of baits and pesticides for control, utilization of cultural control methods, and reduce cost of fire ant management.

Statement: Ground level (tropospheric) ozone is formed near the Earth's surface from the reaction of sunlight and organic hydrocarbons and oxides of nitrogen emitted from automobiles, factories, power plants, and other sources of high-temperature combustion of fossil fuels. Ground-level ozone can be transported long distances to rural areas, thus damaging productive agricultural and forested regions. Auburn University researchers studying the effects ground level ozone on forages, which are abundant in the Southeast, and have shown, using bahiagrass as a model, that high levels of ozone damage not only plant tissue, but also forage quality. Quantifying the impacts of ozone damage on plants helps resource managers, regulators, and policymakers make better decisions about how manage ground level ozone problems and quantify the economic impacts of ozone on livestock and wildlife. This project also has shown that ozone problems extend far beyond the cities, a fact not previously cited in an EPA Air Quality Criteria Document, and will make an important contribution to the current document undergoing revision in 2002.

Key Theme: Integrated Pest Management

Statement: Alabama farmers need help managing insect pests on forage and grain crops. Auburn University researchers are working on ways to do this with a minimal amount of chemicals. They have scouting for potential pests and screening southern adapted wheat varieties for resistance to these pests. They also are assessing control strategies and economic losses from some pests and are determining the usefulness of new Bt-transgenic corn events and hybrids for Alabama farmers. They also are developing a risk index for barley yellow dwarf virus, which typically cause 20-50% yield loss in Alabama wheat. All this work helps reduce losses and costs for Alabama grain farmers while also protecting the environment.

Key Theme: Remote Sensing and Precision Agriculture

Statement: Precision technologies (GPS, GIS, and remote sensing) coupled with proven crop management practices can improve profitability of row crop operations. Auburn University research has centered on using remote sensing to evaluate crop and soil properties to develop management zones for fields and examining new ways that remotely sensed data can be used by producers to save both time and money and also protect the environment. In addition, they evaluating the effects of on-site sewage disposal systems (OSDS) on water quality, since malfunctioning systems lead to environmental pollution. Results from these studies will lead to improved protection of ground and surface water resources and improved management of crops and land. The work on OSDS alone may result in substantial savings for consumers, considering initial costs of OSDS installation range from $3,000 to $7,000, and repairs on malfunctioning systems (due to installation in poor soils) can be costly.

Key Theme: Restoration and Best Management Practices (BMP)

Statement: Increasing the sustainability of vegetable production in Alabama will boost the economy and also protect the environment. Auburn University researchers are developing more sustainable vegetable production methods for growers in Alabama by determining the influence factors, such as cover crops, fertilizer rates, tillage methods, and different varieties, have on growth and yield of pumpkins and other selected cucurbits crops. They have shown that a grower can reduce by one half the amount of nitrogen applied to a pumpkin crop through the use of a legume cover crops, such as hairy vetch or yuchi arrowleaf clover. In addition, the use of strip tillage (a type of minimum tillage) with these cover crops can suppress weeds conserve soil moisture.

Key Theme - Soil Conservation, Quality and Bio-indicators

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 in the east, to the Mississippi border in the west, pose a unique challenge for the land-grant system due to the demographic, social, and economic distinction of the region. 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 more than twice the state average (19%) and more than 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 underdevelopment for this region, while at the same time acknowledging specific areas of potential for development, research at Tuskegee University focuses on the assessment of the current measures for economic growth, equity issues and quality of life indicators as elements of sustainable rural development in the Black-Belt of Alabama.

At Auburn University, research is being conducted on natural resource and environmental issues that affect the rural 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	Approximate Expenditures	SY	Projected Expenditures	SY	Projected Expenditures	SY	Projected Expenditures	SY
1862 (AL)	1,218,759	5	1,149,524	3	1,207,000	3	1,267,350	3	1,330,719	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	1,820,013	8	1,911,012	8	2,006,561	8	2,106,889	8

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

Key Theme: Economic Viability and Sustainable Communities

Statement: Tuskegee University continues to address the problems of economic growth in the Black-Belt counties. Current research is focused on socio economic factors on sustainability of agriculture in these counties for limited resource farmers. Three areas of small and limited resource farm research conducted include factors affecting farm sustainability, alternative enterprises, and estate planning. For the sustainability of small farms in the Black-Belt, descriptive statistics highlighted the low level of education (11 years), reliance of off-farm income (73%), poor farm income ($8,183), and the absence of young people in farming. The empirical estimate indicated that of selected socioeconomic variables, only off-farm income ($21,692) had a statistically significant effect on farm sustainability. This research strengthens the tie between off-farm employment and farm survival. Estate planning is still considered a major determinant of small farm survival. In a sample of African American farmers in the Alabama Black-Belt, 55% did not have any type of estate planning tool in place. In terms of farm-based services, e.g., USDA, the vast majority reported not receiving any government assistance and 65% reported being denied farm loans. Lack of access to farm programs has a negative impact on farm sustainability and results indicate that 70% of the farmers who experience land loss had experienced some form of discrimination. This information helps policy makers and leaders target programs and priorities for this unique population's specific needs.

Statement: Learning why some plants are resistant to bacteria and others are not will help plant breeders develop new ways to manage bacterial problems in crops. Auburn University researchers used genetically-engineered bacteria that glow (bioluminescence) in the dark to track the movement of bacteria precisely and sample the tissue to determine gene activity in response to bacterial pathogen. They found that resistant plant tissue immediately responds to the infection by toughening cell walls, forming lignin-like tough structures and release toxic biochemicals that kill the bacteria. Similar reactions occur in the susceptible plants, however, too late for the plant to resist infection. The research resulted in basic understanding of initial reactions of plants to bacterial infection that can

be used in breeding programs. Eventually, this program will result in resolving bacterial disease problems without use of antibiotics and highly toxic chemicals.

Statement: Alabama has an abundance of natural resources. Citizens of the state are vitally concerned with how these resources are managed. An Auburn University project is uncovering the nature of citizen concerns and how these concerns are communicated. Scientists and policy makers alike benefit from awareness of local knowledge and organizational energy associated with citizen activism associated with natural resource and environmental management. A web-based directory of more than 120 citizen organizations in Alabama has been maintained. This continually updated site has become a standard reference for media as well as for those concerned with natural resource and environmental issues in Alabama and the region. Citizens in one community faced with a local problem are able to identify and network with other citizens and their organizations to learn what strategies have worked in addressing their common concerns.

Key Theme: Small and Family Farm

Statement: Due to the concern for disproportionate number of poor in the state of Alabama (i.e., economic, social, and education) researchers at Alabama A&M University are evaluating 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. Results showed that small farmers 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. This study provides environmental, economic, and educational information to small and limited resource farmers about sustainable practices and marketing strategies for alternative enterprises.

Key Theme: Families and Children

Statement: The apparel and textile industry employs approximately 100,000 people in Alabama, which constitutes over a quarter of the manufacturing workforce. This industry is a significant source of employment for rural residents, and its continued viability is critical to the economic base of Alabama. An Auburn University project is exploring the dynamics of consumer demand and acceptance in image-driven markets, with a particular focus on home textile products derived from Alabama cotton. This project seeks to enhance Alabama market competitiveness through the development of better understanding of consumers' product choices in multiple textile categories using an online format. The project will develop a new methodology to conduct style testing by assessing consumers' visual preferences as assessed online. It will develop an interactive methodology to identify key consumer segments most interested in innovating home textile designs. This approach is relevant to questions of product design, product prototyping and production decisions, diffusion of design innovations, and long-term market positioning in the textile industry.

Statement: Why people stay in abusive relationships is a puzzling question, but many people do remain in difficult and sometimes dangerous situations. Understanding the reasons for this helps mental health and social workers as well as victims make wiser decisions about how to deal with this dilemma. Researchers at Auburn University are developing a model, based on interviews with couples, that may help predict how relationships will progress. One of the goals of this research was to assess the extent to which stay/leave decision-making processes in abusive dating relationships are similar to stay/leave decision-making processes in non-abusive dating relationships. Results indicated that relationship satisfaction and alternatives were equivalent across groups. Investments, however, were differentially related to commitment for the two groups. Results of this work may someday help couples enjoy better, long-term relationships that are free from abuse.

II. Stakeholder Input

Stakeholder input into the planning and priority setting of Alabama's Agricultural Research Programs (AARP) is continuous and includes formal and non-formal processes. The formal process includes conducting statewide surveys of citizens, commodity and advisory groups, farmers, urban and rural families, faculty and students, and 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 that 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.

III. Program Review Process

The Research Directors ensure that the Merit Review Process for 1890 Evans-Allen Research Proposals remain consistent with guidelines published in the Administrative Manual for Evans-Allen Cooperative Agricultural Research (Sec C: Program Administration, Subsection 2b: Project Approval Procedures-Merit Review – 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 and the Handbook for Research Project Leaders for the Alabama Agricultural Experiment Station.

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

The Alabama Agricultural Experiment Station (AAES) participates in 37 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 $819,872. 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 27 projects in the Southern Region, four projects in the North Central Region, three projects in the Northeastern Region, and three 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 the 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. Stakeholder input aids in identifying and addressing the needs of the under-served and under-represented populations in the state.

Some highlighted multi-state projects are "Improved pecan insect and mite pest management systems," "Managing plant parasitic nematodes in sustainable agriculture," "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.

VI. Integrated Research and Extension Activities

The Alabama Agricultural Experiment Station and the Alabama Cooperative Extension Service have 56 integrated research and extension projects. The research portions of the integrated activities are supported by Auburn University through formula funds; however, Extension programs are supported through Smith-Lever formula funds and reported under a separate Plan of Work. The research components of these integrated projects are representative of the five state programs identified in the Alabama Agriculture Research Program's Five-Year Plan of Work and coordinated with the USDA REE goals. The amount of Hatch funds committed to each goal is listed as follows: Goal 1, $1,264,684; Goal 2, $403,744; Goal 3, $179,184; Goal 4, $1,731,577; and Goal 5, $207,232.

Stakeholder input is vital to the establishment of the integrated projects through setting priorities and helping to plan well-balanced projects. This input is through the Alabama Agriculture Experiment Station and College of Agriculture, Auburn University, from stakeholder input such as the 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 the 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. Stakeholder input aids in identifying and addressing the needs of the under-served and under-represented populations in the state. Stakeholder input is also from the Alabama Cooperative Extension System's very comprehensive stakeholder process that utilizes a network of 67 county extension advisory boards and county and state-level program advisory committees.

There are several disciplines with combined research and extension appointments, located at Auburn University. These joint appointments are recognized as state specialist appointments. There are four state specialists in agronomy, two in animal and dairy science, two in poultry science, two in pest management, one in horticulture, two in wildlife management, and one in agricultural economics. These appointments are supported by Hatch and Smith-Lever funds. However, most of the 37 integrated projects have multiple research scientists and extension cooperators on each project.

The integrated projects are titled differently for the research and extension components. Also, often there are several extension components for each research title. For instance, under the research title "Farm-level economics of the Alabama crop and livestock sector," the extension counterparts are entitled " Agricultural business profitability," "Aquaculture," "Live stock performance programs to enhance profitability," and "Economic peanut management for Alabama producers." Another major research title is "Improved culture practices of crustacean and molluscan shellfish in Alabama" with the extension counterparts "Marine fisheries, seafood and coastal issues," "Aquaculture," and "Fisheries and aquatic environments." A total of 99 subtitles in extension correspond to the 56 major topics in research. The importance of the integrated projects is to develop the research and provide the vehicles needed through extension to deliver the results to the users.

V. Multi-state Extension Activities

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

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Certification of the *Annual Report of Accomplishments and Results for Alabama Agricultural Research Programs*, Federal Fiscal Year 2001:

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
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