

PLAN OF WORK

Annual Report of Accomplishments and Results

Institute of Agricultural and Environmental Research
Tennessee State University

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A. Programs

Goal 1: An agricultural system that is highly competitive in the global economy

Overview

Food animal production in Tennessee and the nation is diverse with farmers and ranchers raising traditional livestock as well as considering non-traditional livestock alternatives. Research at Tennessee State University (TSU) is addressing issues concerning basic physiology, general performance, and marketing of selected livestock types for Tennessee and other states. Research efforts in non-traditional alternative livestock include guinea fowl and meat goats. Research efforts in traditional livestock are represented by beef cattle and chickens. This program is focused on developing competitive animal production systems for limited resource farmers in Tennessee and in the surrounding states. Work with alternative livestock is aimed at providing limited resource producers in Tennessee and the Southeast with options to cattle, tobacco, and other traditional farming activities where farmers are losing or are likely to lose market shares.

Nursery crop research is focusing on improvement of selected plant genera to broaden their appeal to consumers and thus enhancing the competitiveness of the Tennessee nursery industry, and on improving the efficiency of nursery crop production. We are also developing a system to improve certain ornamental plants for powdery mildew resistance and bacterial wilt resistance caused by *Ralstonia solanacearum* in certain ornamentals and field crops. Resistant field crops to bacteria could be deployed in tomato and potato growing areas in case of an accidental or malicious dispersal of *R. solanacearum*. Additionally, our researchers are analyzing the structure of the green industry in Tennessee. Other related activities include the development of hands-on teaching and demonstration areas on the TSU campus. These demonstration areas will strengthen teaching, aid in stimulating interest in the plant sciences among high school students, and transfer new discoveries into the hands of limited resource farmers.

Many small farms face a number of challenges including the reduction of government subsidies for certain crops such as tobacco, the decline in farm-generated incomes, and the loss of markets due to the aggregation of agriculture by major corporations. Our efforts towards this concern have included research aimed at enhancing the viability of small farms. These efforts have included production and marketing studies, and studying and developing non-traditional high value niche-crops such as medicinal plants (botanical supplements) for adoption by small farmers. The increased popularity of medicinal plants as alternative medicine in the U.S. and other countries has led to a revived interest in their growth. Current pharmaceutical research has suggested that extracts derived from various *Echinacea* species have a range of medicinally important qualities, such as antibacterial, antidepressant and anti-inflammatory effects. Consequently, propagation, cultivation, and genetic studies are being explored to capitalize on the promising nature of this genus.

Forestland ownership among minorities in the southern states is significant. However, these lands are not contributing significantly to the income of the landowners. Among the reasons that have been attributed to this is the lack of sustainable forest management knowledge among these landowners. In view of this, we proposed in our plan of work to assess the constraints faced by minority forestland owners in Tennessee and develop innovative technical assistance programs

that will empowered them to generate more income from their lands. We are working to build the capacity necessary to address this very important issue.

Total Expenditures (Section 1445 Funds under NARETPA of 1977) – \$1,996,528

Full-time Equivalents – 23.0

Key Theme - Ruminant and Poultry Production Systems

Project Title: Improved production practices in beef cattle and meat goat

- . Research is designed to improve production efficiency in beef cattle enterprises and develop management programs for alternative livestock species (*i.e.*, meat goats). Three key objectives are: 1) assessing physiological alterations in cattle exposed to ergot alkaloids linked to fescue toxicosis, 2) evaluating meat goat maternal breeds for reproductive and maternal traits under conditions typical of the southeastern United States.
- . Impact:
 - Heat-tolerant cattle genetics and endophyte-infected tall fescue were shown to alter weight gain and thermoregulatory behavior in steers. Senepol cattle overcame fescue-induced hyperthermia to exhibit expected growth rates. This result provides for a beef cattle genetics option to address the issue of fescue toxicosis. Understanding how genetic variation in cattle can modify responses to endophytic fescue will help in future endeavors focused on overcoming fescue toxicosis in beef cattle production systems.
 - Recently introduced meat goat breeds were shown to vary for fitness and performance under conditions of the southeastern United States. Awareness that genetic diversity among maternal meat goat breeds for reproductive and fitness traits can influence herd productivity has been increased as a result of outreach activities held across the state and region highlighting these meat goat research findings.
- c. Source of Federal Funds: USDA Evans-Allen
- d. Scope of Impact: State Specific

Key Theme - Ruminant and Poultry Production Systems

Project Title: Selected Nutritional and management factors for improving production efficiency of guinea fowl

- a. In the United States, interest in raising guinea fowl as a meat bird has increased in the last few years. However, poor production and reproduction efficiency have been a potential constraint to increasing bird productivity and profitability. Selected nutritional and management practices for improving production efficiency of guinea fowl broilers, replacement pullets and layers was examined.
- b. Impact:

- Optimum cage and floor space requirement for guinea fowl were published and recommended to guinea fowl producers.
 - Optimum concentrations of metabolizable energy and crude protein in guinea fowl rations were published in the Journal of Poultry Science and recommended to guinea fowl producers.
 - Rations for guinea fowl are now being formulated based on nutrient specifications from this research. These rations have substituted the costly turkey rations that have previously been fed to guinea fowl.
 - Improved management practices especially appropriate floor space allowance and feed efficiency has reduced the cost of producing guinea fowl.
 - One graduate student was trained in research.
- c. Source of Federal Funds: USDA Evans-Allen
- d. Scope of Impact: State Specific

Key Theme - Ruminant and Poultry Production Systems

Project Title: Functional genomics regulating growth, production and reproduction on guinea fowl

- a. Genetic information of guinea fowl which may facilitate genetic improvement programs for the guinea fowl and other poultry species is scarce. The objective was to facilitate understanding of the functionality of guinea fowl genomics through generation of genetic markers for growth, production and reproduction traits.
- b. Impact:
- Guinea fowl genomic DNA sequences were generated and deposited into GenBank for use in comparative mapping of avian species.
 - A genetic similarity of approximately 30% between the guinea fowl and chickens was established. This finding has served as basis for deriving new genetic sequence information for comparative mapping of the avian species.
 - Six undergraduate students and one graduate student were trained in animal biotechnology research. Four undergraduate students completed their independent senior research projects and demonstrated improved research skills. Two of these students have joined veterinary medical schools and are pursuing research projects using skills developed from this project.
- c. Source of Federal Funds: USDA Evans-Allen
- d. Scope of Impact: State Specific

Key Theme - Ruminant and Poultry Production Systems

Project Title: Evaluating economic impact and marketing strategies for the goat industry in Tennessee.

- a. The demand for goat meat has increased significantly over the last few decades due to fast growing U.S. ethnic population. An increase in domestic meat goat production and importation of goat meat indicates that prospects in meat goat production are promising. The main goal of this study was to promote the goat industry as an alternative enterprise to supplement the income of small and limited resource farmers in Tennessee
- a. Impact:
 - Tennessee State University partnered with Tennessee Goat Producers Association to organize the First Annual Caprine Classic Cook Off held in Lewisburg, TN. Twelve contestants entering the competition with twenty-two dishes prepared with goat meat. The event gave a unique opportunity to the general public to taste goat meat cooked in many different ethnic recipes. Attendees were provided with information on consumer awareness and health benefits of goat meat, food safety tips, and educational materials for producers as well as consumers. Data was collected on consumer issues in order to promote meat goat industry during the event.
- a. Source of Funds: USDA Evans-Allen
- a. Scope of Impact: State-specific

Key Theme - Nursery Crop/Green Industry Enhancement

- a. This is a multi-faceted project designed to enhance the profitability of the regional nursery industry by developing new plants and improving propagation/production practices of existing plants. This project also aims at improving the ornamental horticulture teaching capacity at TSU by developing teaching and demonstration areas on the TSU Institute of Agricultural and Environmental Research farm.

Nutrient Use Efficiency: Greenhouse experiments were conducted with controlled release fertilizers on chrysanthemum, poinsettia, and two species of ornamental grasses. Attapulgitite-type clay incorporated into the rooting substrate of chrysanthemum at up to 15% did not adversely affect shoot growth or tissue nutrient concentrations. A rate study with ornamental grasses revealed that these plants require high rates of controlled release fertilizer to obtain maximum shoot growth. With poinsettia, incorporation of attapulgitite-type clay and composted municipal waste at up to 10% did not adversely affect shoot growth or quality.

Cultivar Improvement: Application of genetic engineering technique to *Phlox paniculata* (garden phlox) and *Monarda* spp. (beebalm) to improve their resistance to powdery mildew. Through the use of this technology, disease resistant herbaceous ornamentals can be produced using foreign genes.

Additional basic research involves identification of genes and mechanisms encoding cold and heat tolerance from selected species. Results from this research can be very

important for designing protocols to alleviate damage from extreme weather stressors in nursery production.

Regional poinsettia trials were conducted in conjunction with Kansas State University and the University of Illinois. A total of 63 cultivars from the four major US suppliers were evaluated. A consumer preference survey conducted as part of a poinsettia open house revealed that most participants prefer the traditional red poinsettia, although several new, non-traditional forms were also popular.

Another research goal is to develop genetic linkage maps for Echinacea based on amplified fragment length polymorphism (AFLP) markers amplified from individual pollen grains as well as train minority students in molecular techniques.

Establishment of Teaching/Demonstration Areas: We are continuing to acquire and install new plant species while maintaining existing plants. Infrastructure to support this endeavor continues to be installed.

- b. Impact:
 - Poinsettia cultivars amenable to production in Tennessee were identified, along with consumer preference trends for this high-value floricultural crop.
 - The use of antimicrobial peptide gene technologies developed in this research will greatly speed the development of new disease resistant herbaceous ornamental.
 - Candidate genes for improving cold and heat tolerance have been isolated and will soon be available for genetic transformation to improve sensitive plant species.
 - This project has contributed in training of two TSU undergraduate students and one graduate student in various molecular biology procedures.
- c. Source of Federal Funds: USDA Evans-Allen, 1890 Capacity Building Grants Program, USDA/ARS
- d. Scope of Impact: Multi-State NC, AL, KS, IL.

Key Theme - Small Farm Viability

- a. Exploring, developing and introduction of alternative agronomic crops for small farm operators is considered an approach to keeping small farms viable. During the period under review, IAgER scientists were involved in the identification and improvement of selected genera for their pharmaceutical and other values using conventional and biotechnological means. Researchers are developing propagation and production protocols for superior plants. In addition, another project is examining various issues such as production, sources of information; marketing; research and outreach needs of small farm operators that affect their operations and identify strategies to enhance their viability. The results were presented to farmers, extension agents, community development specialists, policy makers and land grant University researchers at various forums including the Professional Agricultural workers conference at Tuskegee University, the Southern Agricultural Economics Association, the Southern Rural

Sociological Association, the 1890 Association of Research Directors' Symposium, National Small Farm Conferences, the American Agricultural Economics Association, and Tennessee State University Wide Research Symposiums. Results of this project underscore the importance of adopting strategies involving both research and outreach activities to address the issue of achieving profitability by small farm operators. In addition to the above presentations, the findings will be published in the *Journal of Extension* and are expected to provide an important input for small farm operators, extension personnel, policy makers and researchers not only in Tennessee but also other states and countries

- b. Impact:
- Tissue culture protocols for the Tennessee coneflower, the daylily 'Stella de Oro' and a Chinese elm were published; this protocol is a first step in using genetic engineering technologies to improve levels of desirable compounds in these genera.
 - Three species of *Echinacea* (*purpurea*, *pallida* and *angustifolia*) have been evaluated for growth under field conditions during 2000-2003 seasons. Results indicated that *E. purpurea* can be grown successfully in Tennessee under field conditions; this information will inform growers of proper cultural practices for this niche crop.
 - Results of a survey project will provide input for the Extension Program in designing education and outreach activities to assist small farmers in Tennessee. Other states can also use the framework developed for this project to assess the various issues involving factors affecting success in farming, exit and entry decisions as well as field day attendance. Incorporating some of the project survey questions into the USDA/ERS annual survey of Agricultural Resource Management Survey (ARMS) will enrich the database used to analyze farm sector performance at the national level that provides input for policy making.
- c. Source of Federal Funds: USDA Evans-Allen, 1890 Capacity Building Grants Program
- d. Scope of Impact: State Specific

Key Theme - Forest Resources

- a. There is a dearth of information on the minority and limited resource private non-industrial forest (PNIF) owners of Tennessee. Our initial activity is to develop comprehensive databases (spreadsheet and digital) for Tennessee's underserved landowners and farmers. Compilation of data is completed for all forestland owners and farmers in the three counties of Tennessee with the highest minority and limited resource landowners/farmers. Work on the fourth county is nearing completion. A survey instrument identifying types of forestland owners and ownership characteristics is being developed for implementation in the spring. We will use the results of this survey to conduct landowner interviews, workshops, field data collection and demonstrations of potential land use alternatives. The project's activities will lead to increase forest management knowledge among landowners and stimulate their interest in forestry and or agroforestry land use options as alternative sources of farm income

Forests and tree cover also provide significant economic, social and environmental benefits to urban residents. However, much of the forest and tree resources in and around minority and poor urban neighborhoods of Nashville seemed under managed and degraded. We also proposed in our plan of work to: 1) assess the forest and tree resources of select neighborhoods in Nashville, 2) assess attitudes of residents towards urban trees, 3) ascertain expert opinion on best trees to plant and, 4) identify groups that influence the city's urban forest resources.

This effort is in its early stage of development. We are developing a project proposal for submission to the Tennessee Department of Agriculture Division of Forestry. Properly managed urban forests are key components in ameliorating pollution (air, water, soil), urban temperatures, erosion and noise. The urban forest research component will lead to development of a master plan of urban forest management for the city of Nashville. This research will also increase the quality, breadth and depth of students training and enrollment at Tennessee State University, and enhance its capability in the important need areas of natural resource and environmental conservation.

- b. Impact:
No impact to report at this time.
- c. Source of Federal Funds: USDA Evans-Allen
- d. Scope of Impact: State Specific

Goal 2: A safe and secure food and fiber system

0. Overview`

The health and well-being of Americans is necessary for a secure and productive nation. A safe food supply is an essential component in the development of human potential. Knowledge of food handling, especially how consumers store perishable and ready-to-eat foods to keep them safe are key focus areas of the Food Safety, Nutrition, and Family Well-Being Research Team in the Institute of Agricultural and Environmental Research. Projects address concerns about the impact and application of food safety messages, evaluation of food handling practices, and reduction of exposure to food contaminants.

Total Expenditures (Section 1445 Funds under NARETPA of 1977) – \$638,021

Full-time Equivalents – 7.35

Key Theme - Food refrigeration practices of economically disadvantaged consumers in middle Tennessee

- . To help assess the risk level associated with refrigeration of potentially hazardous foods, food safety knowledge and refrigeration practices are being evaluated. In-home studies are in progress. As part of these studies, refrigerator condition and temperatures and potential for cross contamination are being evaluated. The residents are also completing a questionnaire related to their refrigeration practices. Swabs are being collected from the refrigerators to check for microbial contamination levels. Data on the microbial contamination of consumers' home refrigerators provide essential information for the assessment of risk associated with potential contamination of foods during storage.
- b. Impact:
No impact to report at this time.
- c. Source of Federal Funds: USDA Evans-Allen
- d. Scope of Project: State Specific

Key Theme - Innovative methods for rapid detection of food-borne pathogens

- a. This project focuses on the development of innovative methods utilizing phage-displayed recombinant antibodies for rapid detection and identification of *Salmonella* in foods. The specific objectives of this project are to (1) construct cDNA antibody libraries from murine lymphocytes immunologically challenged with surface antigens of *Salmonella*, (2) characterize and screen the libraries for antibodies with diverse specificity to surface antigens of *Salmonella*, (3) develop rapid immunochemical techniques utilizing phage-displayed recombinant antibodies for sensitive detection of *Salmonella* in foods, and (4) validate performance of the developed assays for detection and identification of *Salmonella* in various food products.

- b. Impact:
No impact to report at this time.
- c. Source of Federal Funds – USDA Evans-Allen
- d. Scope of Project – State Specific

Key Theme - Protein markers for verifying inactivation of TSE agents

- a. Surrogate agents for the prion protein associated with TSE diseases will be needed to facilitate research assessing the efficacy of inactivating TSE infectious agents during decontamination/deactivation procedures. The overall goals of this project are: (1) To identify heat- and protease-resistant protein markers that can be used as surrogate agents for prion proteins, and (2) to study denaturation of the protein markers as monitored by monoclonal antibody immunoassays for verifying the efficacy of manufacturing process to inactivate infectious TSE agents. Correlation between denaturation of protein markers and deactivation of prion proteins will be established, and reliability of the immunoassays for predicting deactivation of prion proteins will be evaluated.
- b. Impact:
 - Basic data have been collected that will be used to develop assays to provide effective and rapid measurements to ensure the safety of processed meat products.
- c. Source of Federal Funds – Food and Drug Administration, Department of Health and Human Services
- d. Scope of Project – State Specific

Key Theme - Exploring food safety risk preferences, willingness to pay for safer foods, and impact of food safety education of under-served consumers

- . This research purposes to categorize food safety risk preferences of consumers in rural and under-served areas of Tennessee, examine factors that explain differences in perceptions, and obtain estimates of willingness to pay for safer foods. Conceptual development and refining of the economic models which form that basis for proposed food safety research is on-going. More secondary research was conducted in order to help in fine-tuning the instrument(s) to be used in collecting data for the study. Work on the instrument for collecting data has started. The development of the instrument will be concluded in summer 2005. The target population from which the sample will be drawn is also currently being identified. Primary data collection will start in the fall. Once the instrument for data collected is fully developed, the conceptual model(s) will be evaluated and tested for suitability for collecting the primary data needed for this project.
- . Impact:

No impact to report at this time

- c. Source of Federal Funds – USDA Evans-Allen
- d. Scope of Project – State Specific

Key Theme - Safer fruits and vegetables for Tennesseans

- a. Common methods used by consumers to prepare fruits and vegetables before eating them raw were investigated. Consumers were asked which fruits and vegetables they most commonly eat, those they eat raw, and then what they did to them before they ate them. The effectiveness of the methods used to clean produce by consumers before eating was evaluated. Generally, cold tap water, vinegar, lemon, and vegetable wash solutions reduced *Listeria innocua* population within the same log units, indicating similar effectiveness as cleaning methods. Therefore, running cold tap water is an adequate method to reduce surface microbial contamination on fresh produce.
- b. Impact:
 - Methods that were found to be effective in reducing bacterial contamination have been recommended as continuing practices. A brochure has been prepared that informs consumers about recommended cleaning practices. The brochure is available for distribution through the county extension agents. Thus, consumers will be able to reduce their chances of contracting a food-borne illness from eating fresh produce.
- c. Source of Funds – State of Tennessee Vitamin Settlement
- d. Scope of Project – State Specific

Key Theme - Assessing risk and communicating food irradiation benefits to high risk consumers

- a. This project allows for further development of a proposal submitted that incorporates other investigators and experts in food irradiation, strengthening the nature of the interdisciplinary team. It provided funding to assist TSU researchers in building collaborations with scientists from other disciplines and other institutions in order to enhance a proposal to be re-submitted to USDA for consideration for funding. The collaborations developed will enhance funding chances for the project which was funded earlier as a bridge grant. Secondary data collected by the research associate were used in developing and presenting a paper at a national meeting. A project consultant from Iowa State University was identified for the project. Other collaborations were sought and verbal commitment. Preliminary survey instrument is being developed for data collection when the proposal is re-submitted. The instrument will be fully developed and will be used if the proposal is funded.
- b. Impact:

No impact to report at this time.

- c. Source of Federal Funds: USDA Integrated Food Safety Initiative Bridge Grant
- d. Scope of Project: Tennessee

Key Theme - Characterizing consumer handling, storage, and use of product labels and dates to develop risk communication messages for ready-to-eat foods

- a. Researchers will examine consumer handling and storage of ready-to-eat foods and the use of product labels and dates. In addition, they will assess home refrigerator conditions for potential contamination by food borne pathogens, and use data collected to develop and disseminate messages to consumers about the potential risks of improper handling and storage of ready-to-eat foods. Consumers will also learn how to mitigate these potential risks.
- b. Impact:
No impact to report at this time
- . Source of Federal Funds: USDA Integrated Food Safety Initiative Grant
- d. Scope of Project: Nationwide survey; State institutions collaborating from Tennessee, Kansas, and North Carolina

Goal 3: A healthy, well-nourished population

Overview

Good dietary practices and adequate food distribution are essential components in the development of human potential. Knowledge of what people eat and how they manage their food are key focus areas of the Food Safety, Nutrition, and Family Well-Being Research Team in the Institute of Agricultural and Environmental Research. The team has developed tools that currently are being used in national dietary studies and have established collaborative projects with many government agencies and other private and public entities.

Total Expenditures (Section 1445 Funds under NARETPA of 1977) – \$607,639

Full-time Equivalents – 7.0

Key Theme - Food shopping habits, consumption patterns, and food security status of limited resource households - implications and strategies for change

- a. This program has focused on assessing the educational needs of economically disadvantaged individuals in Tennessee by evaluating the food security status, food stamp usage, nutrient intake, and nutrition knowledge of limited resource individuals and households. Specifically, this project analyzes food purchasing habits and consumption patterns of food assistance recipients and non-recipients in relation to their food security status. Consumers do not appear to be making wise choices with the limited funds that they have at their disposal, irregardless of whether those funds are from government assistance programs or not. Thus, results indicate that food and money management education is needed for all limited resource individuals. Further research into factors contributing to food insecurity ratings is being conducted. As part of this purchasing patterns and food pantry studies are planned.
- b. Impact:
 - Strategies are being developed that will encourage limited resource individuals to adopt wise shopping habits and increase their consumption of nutritionally balanced food.
- c. Source of Federal Funds: USDA Evans-Allen
- d. Scope of Project: State Specific

Key Theme - Assessing the food security status of non-profit food assistance recipients in Alabama, North Carolina and Tennessee

- . Various studies show that the number of non-profit food assistance centers as well as recipients of such assistance increased in recent years. This project is aimed at assessing the food security status of those served by selected non-profit food assistance agencies in metro and non-metro counties in Alabama, North Carolina and Tennessee and compare the results within and among the states.

- . Impact:
No impact to report at this time.
- . Source of Federal Funds: Southern Rural Development Center
- . Scope of Project: Tennessee, North Carolina and Alabama

Key Theme - Assessing the barriers to increasing fruit and vegetable consumption among economically disadvantaged population groups

The overall goal is to increase the number of fruits and vegetables consumed by participants, and to improve the methods used to assess dietary intakes of fruits and vegetables. To achieve this goal, research has focused on assessing fruit and vegetable consumption of Tennesseans, especially limited resource individuals. Methods of reporting amounts consumed, types of fruits and vegetables eaten, preparation methods, and perceived barriers to consuming greater amounts of fruits and vegetables have been investigated. Three different surveys and follow-up discussion groups have been completed to try and assess means by which consumers could be encouraged to consumer greater amounts of fruits and vegetables.

- b. Impact:
No impact to report at this time.
- c. Source of Federal Funds: USDA Evans-Allen
- d. Scope of Project: State Specific

Key Theme - Techniques for effective recruiting of minority and other hard-to-reach populations for participation in consumer health-related research

- a. While studies have been performed to evaluate various programs offered to minority populations, none have been conducted that specifically investigate the reasons these population groups do not participate in health-related studies, thus resulting in low representation in these studies. This project examines reasons for lack of involvement by minorities in health-related research and investigates methods for increasing participation. It will also determine areas of consumer health research in which African American, Latinos, and other hard-to-reach populations feel the need to participate. In Phase I focus groups, using persons from three population groups, were conducted to determine the consumer's knowledge of health, perception of health and well-being and the practice of prevention.
- b. Impact:
No impact to report at this time.
- c. Source of Federal Funds: USDA Evans-Allen

- d. Scope of Project: State Specific

Key Theme - A simplified, rapid tool for estimating portion size in dietary studies

- c. Estimating what one ate is difficult, especially if you do not know you are going to be asked to report that information. Techniques currently used for reporting such information lead to large errors in reporting for many foods. Additionally, the task is cognitively challenging and even highly intimidating to some persons. Thus, the purpose of this study was to investigate whether a more simplified method could be used in reporting such data – one using descriptive size terms. This research found most people did not believe the three-word scale was adequate to report the intake of varying amounts of foods. Thus a five-word scale and a ten point scale were assessed, followed on different kinds and amounts of foods. As a follow-up a seven-word scale is being tested on foods that contribute a high amount of calories and nutrients to the diet, and are hard to estimate intake by other reporting methods.
- c. Impact:
- It is anticipated that the three-point scale currently used for reporting amounts of food consumed will be altered after completion of this project.
- c. Source of Federal Funds – USDA Capacity Building
- c. Scope of Project: Tennessee and Kansas

Key Theme - Food safety education for the hard-to-reach and underserved communities

- a. The goal of these projects was to design a survey to be used in collecting food safety information from the hard-to-reach communities in Alabama and Tennessee. Information collected would also be used in developing educational materials for communicating food safety issues to this target group in Alabama.
- b. Impact:
- Project questionnaire developed collaboratively with participating institutions allowed researchers and extension professionals to develop closer working relationship across their different disciplines.
- c. Source of Federal Funds: USDA/CSREES
- d. Scope of Impact: Multi-State Research – TN, NC and AL

Goal 4: Greater harmony between agriculture and the environment

Overview

The invasion of highly destructive pests and diseases into agriculture has required the rapid development of pest and disease control programs, most of which rely on the use of toxic chemicals. Public perception about the safety of these chemicals requires studies of their persistence and movement in soil and surface waters, and studies of alternative pest and disease control methods. IAgER's Environmental Protection and Enhancement Researchers are directing their research efforts toward identifying and reducing the effects of hazardous agricultural chemicals on the environment.

Total Expenditures (Section 1445 Funds under NARETPA of 1977) – \$1,032,986

Full-time Equivalents – 11.90

Key Theme - Integrated Pest Management; Improving Environmental Quality

- a. Our research efforts have included the following: (1) the evaluation of Japanese beetle, imported fire ant, and other potential insect pest control measures in nursery production; (2) the evaluation and development of alternative control measures for plant-parasitic nematodes in nursery crop production, (3) development of powdery mildew resistance in dogwood and analysis of the pathogens, and (4) evaluation of environmentally friendly alternatives to fungicides for the management of foliage diseases in nursery production.
- b. Impact:
 - Newly identified dogwood cultivars resistant to powdery mildew will result in substantial savings on treatment costs by eliminating the need for fungicides.
 - Biorational compounds used as alternatives to traditional fungicides have been identified for powdery mildew control. Growers who wish to use these compounds along with fungicides can reduce fungicide use by about 56-66%, and growers who wish to abstain from using traditional fungicides can reduce fungicide use to zero.
 - A new insecticide product containing imidacloprid and cyfluthrin was approved in the 2004 U.S. Domestic Japanese Beetle Harmonization Plan based on this project, saving producers about \$1,482 / treated hectare.
 - Favorable data were collected to support several insecticides in Japanese beetle (JB) and fire ant (IFA) quarantines, providing alternatives to chlorpyrifos.
 - New pesticide treatments ensure growers have viable and low cost options for shipping millions of pieces of Tennessee nursery stock in the event currently approved treatments become unavailable.
 - Laboratory studies with soil-incorporated imidacloprid and halofenozide had minimal impact on *Tiphia* wasps, but foliar applied imidacloprid was toxic. Results suggest post-treatment irrigation or sub-surface placement of insecticides may improve compatibility with *Tiphia* wasps. Fungicides and one herbicide were also compatible with *Tiphia* wasps.

- Trapping methodologies were developed to accurately collect buprestid borers; these traps are being used in the multi-million dollar campaign against Emerald Ash Beetle in the central US.
- c. Source of Federal Funds: USDA Evans-Allen; CSREES 1890 Capacity Building Grants, USDA/APHIS
- d. Scope of Impact: Multi-State, KY, FL, MS, MI, OH

Key Theme - Sustainable Agriculture

- a. Adsorption and desorption of five widely used pesticides were utilizing both batch technique and column of soil materials. In batch studies, the factors affecting pesticide adsorption-desorption include time, temperature, soil type, organic matter, pesticide concentration, temperature, pH, and inorganic electrolytes. Column studies with the above soils/soil materials and all the pesticides examine various pesticide concentrations, and different water fluxes. Applicability of a mathematical model, based on chromatographic theory to predict pesticide movement, will be tested.
- b. Impact:
- Improved methods of measuring the movement of the pesticide triclopyr were developed. The new method requires less time and eliminates the generation of diazomethane, a potentially explosive chemical, during analysis. This finding improves the efficiency and safety of the technique used to measure this pesticide.
- c. Source of Federal Funds: USDA Evans-Allen
- d. Scope of Impact: State Specific

Key Theme - Salt-loading assessment of plant nursery soils mapped with geographic information systems

- a. The goal of the research is to monitor nursery soils salinity level as a function of apparent soil electrical conductivity (EC_a). An *in situ* field survey with electromagnetic induction (EMI) ground conductivity sensor is being used to determine EC_a in irrigated and non-irrigated nursery fields.
- b. Impact:
- Apparent soil electrical conductivity (EC_a) is a promising indicator for important soil physical and chemical properties.
- c. Source of Federal Funds: USDA Evans-Allen
- d. Scope of Impact: State Specific

Key Theme - Remediation/mitigation of chemical contamination in the environment

- a. The nursery industry in Tennessee relies heavily on pesticides to control highly destructive pests and pathogens of nursery crops. Such large use of pesticides can result in undesirable intrusions of the chemicals into vulnerable ecosystems where they threaten health of humans, wildlife and the environment. Plant systems can be used to clean up or alleviate adverse impacts chemical pollutants in the environment; however, there are still aspects of the processes that are not well understood, which in turn has limited full deployment of the practice in the field. We are investigating abilities of different plant species to enhance degradation of the insecticides chlorpyrifos, bifenthrin thiamethoxam and chlordane. The first three chemicals are used heavily or are being considered for use in nursery production. Chlordane was banned from use by the EPA in 1988 because of its adverse human health and environmental impacts. However, the pesticide has continued to be cited as a chemical pollutant in many sediments in Tennessee. Our laboratory activities involve analysis of chemicals (pesticides as well as plant exudates into soil) and examination of microbial populations in plant root zones (rhizospheres) to understand the interactions that cause accelerated degradation in rhizospheres.
- b. Impact:
No impact to report at this time.
- c. Source of Federal Funds: USDA Evans-Allen
- d. Scope of Impact: State Specific

Key Theme - Water Quality--Non-point Source Water Pollution

- a. Until recently, most concerns about environmental pollution focused on large intrusions of chemicals into the environment from accidental spills or improper disposal or discharge practices (point source pollution). Those concerns were and still are well deserved. Large intrusions of chemicals into the environment invariably result in catastrophic ecosystem impacts including acute toxicities to life forms. Although tragic, the sources of such environmental events are readily identifiable and in many instances readily controllable even if at great fiscal cost. Now, attention has shifted to perhaps a more insidious type of pollution: Non-Point Source Pollution (NPS). In contrast to point source pollution, NPS pollutants do not arise from a single location; rather, they come from diffuse sources, thereby making source identification and control daunting tasks. The two most frequently cited non-point source water pollutants in Tennessee are silt and bacteria. Bacterial pollution of streams, lakes and rivers poses serious health threats to communities through ingestion of contaminated drinking water, or food that has come into contact with contaminated water. One of the urgent research needs for addressing non-point source pollution is identification of the pollutant source which in turn will allow for immediate action. We recently submitted a proposal to investigate non-point source pollution of waters. The major focus of the proposed work is on development

and/or improvements of bacterial source tracking methods and development and/or improvement of strategies to prevent pollution in the first place.

- b. Impact:
No impact to report at this time.
- c. Source of Federal Funds: USDA Evans-Allen
- d. Scope of Impact: State Specific

Goal 5: Enhanced economic opportunity and quality of life for Americans

Overview

The nursery crop sector of the green industry is one of the most profitable and important economic sectors in Tennessee. As an agricultural crop, soybeans and tobacco surpass nursery crop production in the state. Conspicuously absent from the overall ownership of this lucrative sector are minorities. A study conducted by Tennessee State University in 1996 found that most minorities in the green industry occupied or had ownership in the less lucrative landscaping or lawn care sector of the industry. As minority or limited resource farmers are forced out of farming traditional agronomic crops such as tobacco, they will need viable alternative crops.

In addition to studies dealing specifically with enhancing opportunities for minorities in nursery sector, our team is working on several projects on involving the nursery industry in Tennessee, small farms, rural development, welfare reform, food assistance and food security. Team members are collaborating with government agencies at the federal, state and local levels, land grant universities, stakeholders, agribusinesses, and nonprofit organizations. The overall objective of research performed under this goal is to conduct economic and policy analyses of issues that affect the well being of local, state, regional, national, and global communities. Results from this research will be useful for policy making and thus contribute the economic enhancement of communities in our state and in other regions.

Research is also being conducted in the area of social acceptability of agricultural biotechnology, specifically, genetically modified crops. Data will be gathered on the attitudes of US consumers and producers towards genetically modified organisms in the food system.

Total Expenditures (Section 1445 Funds under NARETPA of 1977) – \$724,826

Full-time Equivalents – 8.35

Key Theme - The green industry in Tennessee; structure, marketing, economic impact and prospects

- a. Information on structure and performance of the industry, impacts generated by the industry, and prospects for long-term growth of the industry will be collected from the study. The project will collect and disseminate information that may be used in facilitating economically sound decisions by industry participants in the state of Tennessee. Issues facing minority and other producers interested in participating in the industry will also be examined.

The overall goals of proposed project are to analyze current structure of the green industry in Tennessee, and examine current marketing channels used by wholesalers and retailers of nursery products and services in addition to assessing opportunities for minority, small and limited resource farmer participation in the nursery. Finally, the project will examine risks faced by participants in the industry. Specific objectives of this study include: (1) describing and analyzing the current structure and problems of the

green industry in Tennessee, (2) assessing the size of selected segments of the green industry and determining the economic impacts of the nursery industry on selected local communities and the economy of the state; (3) determining factors affecting consumer demand for nursery products and landscape services in the state and assessing the short, medium and long-term growth prospects of the industry; (4) identifying, and evaluating marketing channels, marketing and merchandising practices, and investigating presence of barriers to development of domestic and international markets for nursery and greenhouse products; (5) assessing opportunities for minorities, small, and limited resource farmers to participate in the state's nursery and greenhouse industry, and (6) examining risks that face new, minority, small and limited resource farmers desiring to diversify into the industry.

During the period covered in this report, two bulletins that discuss the structure and the economic contributions of the industry to the economy of the state have been prepared. A questionnaire to be used in collecting data from businesses selected to participate in the survey has been pilot tested for use in collecting data. Temporary data collectors have been hired and trained on how to administer the questionnaires developed for the project. Student workers needed for the project have been recruited. They have assisted in developing profile for the industry in Tennessee and generating the random samples of businesses to be surveyed for the study. They are also assisting in preparing the mail survey to be conducted.

- b. Impact:
 - Students working with researchers have improved their research, computer, writing and oral communication skills. These students are currently preparing papers for oral and poster presentations at regional and national meetings.
 - Copies of findings to date have been distributed to nurserymen and other producers of nursery products via the TSU Nursery Research Center in McMinnville, Tennessee. This bulletin provides very useful information to the producers and will help them understand more about the structure of this complicated industry and improve their marketing skills.
 - A bulletin exploring the issue of diversifying the farm population in the south has been published.
- c. Source of Federal Funds: USDA Evans-Allen
- d. Scope of Impact: Multi-State AL, MS

Key Theme - Contributions of agriculture and manufacturing to rural development in Southern States

- a. The overall goal of this grant is to assess the contributions of the agricultural and manufacturing sectors to the economy of rural areas in Alabama, Mississippi, and Tennessee. During the period January 2002 to December 2002, the U.S. Forest Service (USFS) offered a mini-IMPLAN training to project researchers from Tennessee State University. The small workshop was given by Dr. Rodney Busby of the research station

in New Orleans, Louisiana. The USFS also assisted with the updating of the IMPLAN data file to be used in estimating impacts of manufacturing and agriculture to rural economies of the states previously identified in the project. Contacts were made with Middle Tennessee State University and Tuskegee University, collaborators on the project. Middle Tennessee State and Tennessee State Universities acquired databases to be used in selecting businesses to be surveyed. These databases will be used in conjunction with other selection tools to ensure that participants targeted are representative of the businesses actually selected for the survey. Participating states are continuing their work with identifying the specific companies to be surveyed and the extent to which face-to-face interviews may be used to supplement information collected from mailed questionnaires. The Southern Rural Development Center, the Mississippi Rural Development Council, the Economic Research service, and the US Forest Service continued with their advisory role in the project.

- b. Impact:
 - Expanded skills of researchers from the participating universities and strengthened collaborations among the Economic Research Service, the US Forest Service and collaborating institutions. Also, students at Tennessee State University have improved their computer skills from working on the project through learning how to search for data, conducting qualitative/quantitative analyses and other important components of research.
- c. Source of Federal Funds: USAD/CSREES 1890 Capacity Building Grants Program
- d. Scope of Impact: Multi State Research AL ,MS

Key Theme - Food safety practices and risk reduction education for rural residents of selected states

- a. Overall goal of project is to build Tennessee State University's capacity in the area of food safety research. The project focuses on the rural residents in Alabama, North Carolina and Tennessee. Through this research, student research skills will be enhanced through active participation in all aspects of data collection and analysis. Collaboration between Tennessee State University and two USDA agencies -- the Food Safety Information Service (FSIS) and the Economic Research Service (ERS) – will strengthen the University's research in this area. The project will strengthen campus inter-departmental collaboration between food scientists, nutritionists, extension food safety professionals, and agricultural economists. Information and skill sharing among scientists will enhance research, teaching, and student learning at Tennessee State University. Other 1890 and 1862 institutions participating in the project with TSU are: Alabama A&M University, North Carolina A&T State University, and the University of Tennessee, Knoxville.
- b. Impact:
No impact to report at this time

- c. Source of Federal funds: USDA/SCREES 1890 Capacity Building Grants Program
- d. Scope of Impact: Multi-State Research – TN, AL, NC

Key Theme – Collaborating across disciplines in communicating social aspects of biotechnology

- a. The project was an extension of a USDA-funded project undertaken by four land-grant universities in Arkansas, North Carolina and Tennessee. The specific objectives accomplished by the project were: (1) establishing a web page on the TSU web site to disseminate findings of the USDA-funded biotechnology project to the general public, (2) holding a conference as a way to bring scientists from industry, private sector, and academic institutions to discuss issues related to the communication of biotechnology to the media and public. The conference, “Communicating Biotechnology: Examining the Issues,” was held on the campus of TSU, November 11 – 12, 2004. About 80 participants took part in the conference supported by the Farm Foundation. The Institute of Agricultural and Environmental Research (IAgER) hosted the conference. Presenters from industry, academia, and private sector made presentations on the art and science of communicating biotechnology. This conference was planned collaboratively by the participating universities: TSU, NC A&T, UARK, and UAPB. The conference provided the opportunity to showcase the project. The role of the Farm Foundation as a partner with land grant universities in fostering research, education and outreach was given special recognition at the joint conference.
- b. Impact:
 - The project focused on setting up a network to communicate findings of the USDA-funded project so that results can be readily available to stakeholders (farmers, consumers, and others), policy-makers and community leaders. Eighty people attended the 1-day conference on communicating biotechnology.
- c. Source of Federal Funds: None. Funded by the Farm Foundation
- d. Scope of Impact: Multi-State Research TN, AR, and NC

Key Theme - Development of internet-based education for bio-based product information: preparing students for careers in agriculture

- a. This project is a teaching capacity building grant project awarded by the USDA/CSREES to help graduate agriculture/agribusiness students through development of a bio-based product curriculum as electives to be explored while completing their degree. The curriculum will examine key drivers of the industry. The designed curriculum will interface with Internet-based databases to give students a good understanding of the ever-

expanding bio-based products industry. The courses to be developed for bio-based product information will prepare students for more careers in agriculture.

- b. Impact
 - On-line project questionnaire was developed. Symposia have been offered at professional meetings organized by the Southern Agricultural Economics Association meetings in Mobile, Alabama and Tulsa, Oklahoma. One symposium proposal is currently being reviewed for presentation at the American Agricultural Economics Association meeting in Providence, Rhode Island in July 2005.
- c. Source of Federal Funds: USDA/CSREES
- d. Scope of Impact: Multi-State Research – TN

Key Theme - Strengthening teachers' and students' knowledge of agricultural biotechnology through hands-on workshops and outreach

- a. The goal of the project is to build on Tennessee State University's effort in biotechnology education by providing hands on training for middle and high school teachers and college students.
- b. Impact:
 - Thirty eight teachers have been trained and a similar number will receive training in the summer of 2005. The training enhances the knowledge and confidence of the teachers to teach the subject in their schools. Four undergraduate students have been trained as interns during the summer of 2004 and some have continued on as graduate students getting training in the laboratory.
- c. Funding Source: USDA-CSREES
- d. Scope of project: Tennessee

Key Theme - Southern Agricultural Biotechnology Consortium for Underserved Communities

- a. The Southern Agricultural biotechnology Consortium for Underserved Communities (SACUC) is a multi-state, multi-disciplinary project involving joint effort of eleven 1890 institutions, industrial partners, governmental agencies, and farm organizations to promote agricultural biotechnology outreach to farmers and consumers and strengthen K-12 Life science education.
- b. Impact:
 - The project provided training, laboratory equipment and supplies and other resources for teachers in five counties in the state as part of its education outreach; community

outreach was conducted through meetings with extension agents, farmers and others; commodity outreach was conducted through trials and demonstration of six commodities on farmers' plots in five counties. Scio-economic studies involving knowledge of producers and consumers in underserved communities about biotechnology and related issues show the need to provide education about the technology by various groups. The Institute of Agricultural and Environmental Research at Tennessee State University hosted the last consortium meeting that highlighted impact of the project by various stakeholders. Project results are summarized in brochure and also published in an applied journal. Final project reports from the collaborating institutions are being compiled by Alabama A & M University which is the lead institution. Project results from all eleven collaborating institutions including Tennessee State University can be found at <http://www.sacuc.subr.edu>.

- c. Source of Federal Funds: USDA/CSREES
- d. Scope of Impact: Multi state Integrated Research and Extension with AL, MS, FL, LA, OK, NC, TX, GA, and AR.

Key Theme - Participation of Latino/Hispanic population in the food stamp program in the South

- a. The Hispanic population is growing rapidly in the U.S., particularly in the southern states. This rapidly growing population is characterized by high poverty rates among children and elderly age groups. The majority of the population is not aware of the Food Stamp Program (FSP) and their eligibility to participate in the program. The goal of this study was to acquire an understanding of the dynamics of the Latino/Hispanic population and their participation in the FSP.
- b. Impact:
 - Project team from Tennessee State University conducted meetings with nearly 400 Hispanics in five locations in Tennessee and Kentucky. The survey results helped to identify barriers and recommend strategies that will increase their participation in the program.
 - Final report of the project was presented at the USDA-ERS Small Grants Conference on December 2-3, 2004 in Washington, DC. The participants of the conference include researchers, private organizations and food stamp policy makers from national and regional levels. The final report and results are available at the SRDC website.
- c. Source of Funds: Southern Rural Development Center
- d. Scope of Impact: Tennessee and Kentucky

B. Stakeholder Input Process

Various actions were taken to seek stakeholder input and incorporate this input into research plans. These actions were tailored to fit individual goals and stakeholder groups. For example in Goal 1 (An agricultural system that is highly competitive in the global economy) the Institute of Agricultural and Environmental Research has maintained a standing Nursery Advisory Group since 1995. The group is composed of small, medium and large nursery producers from across the state and meets annually to review the methods and outcomes of applicable research conducted in the department. Comments from the group are used in formulation of research plans and methodologies.

In Goals 2 and 3 (A safe and secure food and fiber system; A healthy well-nourished population), an Advisory Council was formed that includes persons who work with disadvantaged populations, including the Nashville Davidson County Health Department, Second Harvest Food Bank, Metropolitan Davidson County Health Department, Cooperative Extension Program Agents, Davidson County Sheriff's Department, and the Hispanic Coalition. This advisory council participates in a review process of targeted research areas.

Research conducted under the 'Greater harmony between agriculture and the environment' goal (Goal 4) sought stakeholder input through professional meetings, field days, demonstrations, consultations, and informal contacts. This input was discussed by the research team and used to identify and assess insect and nematode pests, plant diseases, species of experimental plants, pesticides, and cultural practices included as part of the overall research projects. Agricultural statistics published by the Tennessee Department of Agriculture, the National Agricultural Statistics Service, and the Tennessee Agricultural Statistics Service were consulted to determine the economic importance of crops, pests, and diseases.

In the case of Goal 5, 'Enhanced economic opportunity and quality of life for Americans', information provided in identified areas of research will be of significant value to stakeholders, who are identified through: (1) the participation of Non-Governmental Organizations (NGOs) and private organizations in our projects, (2) the inclusion of farmers as cooperators, collaborators, or advisors on projects, and (3) publication and distribution of research bulletins, industry magazines, and leaflets that are widely circulated among growers, producers and extension workers. The involvement of extension colleagues (formally and informally) has extended our outreach efforts to more stakeholders. Through attendance at nursery industry trade shows, farmer field days, farmer meetings, and workshops, we have been able to identify growers who have stakes in our research. Also we are able to identify stakeholders through our interactions with other researchers, and extension personnel, we have identified stakeholders with interest in our programs.

C. Program Review Process

There have been no significant changes in our program review process since submission of our Plan of Work.

D. Multi State and Joint Activities / Integrated Research and Extension Activities

Although not discussed in great detail in the individual reports and impact statements, the research activities outlined in this report involve a fair amount of multi state and joint activities.

In Goal 1, Nursery Crop Green Industry Enhancement, the nutrient use efficiency research is being conducted as part of a multi-state project involving scientists from North Carolina, Georgia and Alabama. Also under Goal 1, the Small Farm Viability research has as a direct output defined crop growth and culture parameters for the Extension Service to incorporate into their outreach programs targeting small farm operators. Additionally, researchers have conducted outreach efforts via workshops and symposia presented in the important cattle and goat production areas of the state.

Researchers from Kansas State University are significantly involved in the portion aid research described in Goal 3, Nutrition Education for Disadvantaged Populations. The Kansas researchers are performing portions of the research as well as providing consultation on methodological approaches.

The research conducted as part of the Integrated Pest Management theme (Goal 4) utilizes collaborative arrangement with scientists from the University of Kentucky and North Carolina State University to evaluate putative resistant dogwood varieties under their respective growing conditions. The fire ant and Japanese beetle research utilizes collaborators from USDA/ARS Biocontrol and Mass Rearing Research Lab (MS), USDA/APHIS Gulfport Plant Protection Station (MS), USDA/ARS Center for Medical, Agricultural and Veterinary Entomology (Gainesville, FL), USDA/ARS Horticultural Insect Research Laboratory (Wooster, OH), USDA/APHIS Niles Biological Control Laboratory (MI), and the USDA/APHIS Otis Pest Survey, Detection, and Exclusion Laboratory (MA). These locations are performing integral parts of the analysis of the insect research and/or providing labor to gather data on experiments conducted in Tennessee.

A large number of multi-state collaborations take place in the activities described in Goal 5, Enhanced Economic Activity and Quality of Life for Americans. Scientists and extension personnel from Alabama A&M, Kentucky State University, North Carolina A&T, Alcorn State University, and the University of Tennessee work jointly with TSU scientists to gather data and formulate contacts to be used in future research proposals dealing with economic opportunity in the Southern US. Other activities described under this goal involve collaborators with research and extension personnel from Florida A&M University, Fort Valley State University, Langston University, Middle Tennessee State University, Prairie View A&M University, Southern University, South Dakota State University, Tuskegee University, University of Arkansas (Fayetteville), University of Arkansas (Pine Bluff) and the University of California at Davis.

E. Fiscal and Human Resources Allocated for FY2003-2004

Evans-Allen Funds

Goal I: An Agricultural Production System That is Highly Competitive in the Global Economy

Program #	Description	FTE	Budget
Program 1.	Ruminant and Poultry Production Systems	9.90	\$ 859,375
Program 2.	Nursery Crop/Green Industry Enhancement	6.00	\$ 520,833
Program 3.	Small Farms Viability	5.60	\$ 486,111
Program 4.	Forest Resources	1.50	\$ 130,208
Total		23.0	\$ 1,996,528

Goal II: A Safe and Secure Food and Fiber System

Program 5.	Food refrigeration practices of economically disadvantaged consumers in Middle Tennessee	1.40	\$ 121,528
Program 6.	Innovative methods for rapid detection of food-borne pathogens	0.80	\$ 69,444
Program 7.	Protein markers for verifying inactivation of TSE agents	0.50	\$ 43,403
Program 8.	Exploring food safety risk preferences.....food safety education of under-served consumers	2.00	\$ 173,611
Program 9.	Safer fruits and vegetables for Tennesseans	0.75	\$ 65,104
Program 10.	Assessing risk and communicating food irradiation benefits to high risk consumers	0.40	\$ 34,722
Program 11.	Characterizing consumer handling, storage,develop risk communication messages for ready-to-eat foods	1.50	\$ 130,208
Total		7.35	\$ 638,021

Goal III: A Healthier, More Well-Nourished Population

Program 12.	Food shopping habits, consumption patterns, and food households - implications and strategies for change	1.00	\$ 86,806
Program 13.	Assessing the food security status of non-profit food assistance recipients in AL, NC and TN	1.00	\$ 86,806
Program 14.	Assessing the barriers to increasing fruit and vegetable consumption population groups	1.00	\$ 86,806
Program 15.	Techniques for effective recruiting of minority and other hard-to-reach populations health-related research	1.00	\$ 86,806
Program 16.	A simplified, rapid tool for estimating portion size in dietary studies	1.00	\$ 86,806
Program 17.	Food safety education for the hard-to-reach and underserved communities	2.00	\$ 173,611
Total		7.00	\$ 607,639

Program #	Description	FTE	Budget
<i>Goal IV: Greater Harmony Between Agriculture and the Environment</i>			
Program 18.	Integrated Pest Management; Improving Environmental Quality	7.00	\$ 607,639
Program 19.	Sustainable Agriculture	1.00	\$ 86,806
Program 20.	Salt-loading assessment of plant nursery soils mapped with geographic information systems	1.50	\$ 130,208
Program 21.	Remediation/mitigation of chemical contamination in the environment	1.20	\$ 104,167
Program 22.	Water Quality--Non-point Source Water Pollution	1.20	\$ 104,167
Total		11.90	\$ 1,032,986
<i>Goal V: Enhanced Economic Opportunities and Quality of Life for Americans</i>			
Program 23.	The green industry in Tennessee; structure, marketing, economic impact and prospects	3.10	\$ 269,097
Program 24.	Contributions of agriculture and manufacturing to rural development in Southern states	0.75	\$ 65,104
Program 25.	Food safety practices and risk reduction education for rural residents of selected states	0.50	\$ 43,403
Program 26.	Collaborating across disciplines in communicating social aspects of biotechnology	0.75	\$ 65,104
Program 27.	Development of internet-based education for bio-based product information: preparing students for careers in agriculture	0.75	\$ 65,104
Program 28.	Strengthening teachers' and students' knowledge of agricultural biotechnology through hands-on workshops and outreach	1.25	\$ 108,507
Program 29.	Southern Agricultural Biotechnology Consortium for Underserved Communities	0.75	\$ 65,104
Program 30.	Participation of Latino/Hispanic population in the food stamp program in the South	0.50	\$ 43,403
Total		8.35	\$ 724,826
		FTE	Budget
Grand Total for all Goals ----		57.6	\$ 5,000,000