Memo

Date: March 23, 2006

To: Mr. Bart Hewitt, Program Analyst
Cooperative State Research, Education, and Extension Service

From: Dr. Stephen H. Kolison, Dean and Director
Institute of Agricultural and Environmental Research
Tennessee State University

RE: 2004-2005 Plan of Work Annual Report

Attached is our 2004-2005 Plan of Work Annual Report. If you have questions or correspondence pertaining to this report please contact me at skolison@tnstate.edu (615.963.2194) or Dr. Nick Gawel at gaweln@blomand.net (931.668.3233).

PLAN OF WORK

Annual Report of Accomplishments and Results

Institute of Agricultural and Environmental Research

Tennessee State University

Federal Fiscal Year 2004-2005

Table of Contents

A. Programs....4

Goal 1: An agricultural system that is highly competitive in the global economy....4

Key Theme: Ruminant and poultry production systems....5
Key Theme: Ruminant and poultry production systems....5
Key Theme: Ruminant and poultry production systems....6
Key Theme: Ruminant and poultry production systems....7
Key Theme: Nursery crop/green industry enhancement....8
Key Theme: Small farm viability....9
Key Theme: Forest resources....10

Goal 2: A safe and secure food and fiber system....12

Key Theme: Food refrigeration practices of economically disadvantaged consumers in middle Tennessee....12
Key Theme: Innovative methods for rapid detection of food-borne pathogens....13
Key Theme: Protein markers for verifying inactivation of TSE agents....13
Key Theme: Exploring food safety risk preferences, willingness to pay for safer foods, and impact of food safety education of under-served consumers....14
Key Theme: Safer fruits and vegetables for Tennesseans....14
Key Theme: Assessing risk and communicating food irradiation benefits to high risk consumers....15
Key Theme: Characterizing consumer handling, storage, and use of product labels and dates to develop risk communication messages for ready-to-eat foods....15

Goal 3: A healthy, well-nourished population....17

Key Theme: Food shopping habits, consumption patterns, and food security status of limited resource households - implications and strategies for change....17
Key Theme: Assessing the food security status of non-profit food assistance recipients in Alabama, North Carolina and Tennessee....18
Key Theme: Assessing the barriers to increasing fruit and vegetable consumption among economically disadvantaged population groups....18
Key Theme: Techniques for effective recruiting of minority and other hard-to-reach populations for participation in consumer health-related research....19
Key Theme: A simplified, rapid tool for estimating portion size in dietary studies....19
Key Theme: Food safety education for the hard-to-reach and underserved communities....21

Goal 4: Greater harmony between agriculture and the environment 22

Key Theme: Integrated pest management; improving environmental quality.....22
Key Theme: Sustainable agriculture.....23
Key Theme: Salt-loading assessment of plant nursery soils mapped with geographic information systems.....23
Key Theme: Remediation/mitigation of chemical contamination in the environment 24
Key Theme: Water quality-non-point source water pollution 25
Key Theme: Global information systems 25

Goal 5: Enhanced economic opportunity and quality of life for Americans.....26

Key Theme: The green industry in Tennessee; structure, marketing, economic impact and prospects.....26
Key Theme: Food safety practices and risk reduction education for rural residents of selected states.....27
Key Theme: Strengthening teachers' and students' knowledge of agricultural biotechnology through hands-on workshops and outreach.....28
Key Theme: Southern Agricultural Biotechnology Consortium for Underserved Communities 28
Key Theme: Participation of Latino/Hispanic population in the food stamp program in the South. 29

B. Stakeholder Input Process.....30

C. Program Review Process.....30

D. Multi State and Joint Activities / Integrated Research and Extension Activities 30

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 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 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 efficient use of nutrients and water during crop production. A second focus is the evaluation of poinsettia cultivars and their appeal to consumers, thus enhancing the competitiveness of this portion of the green industry in Tennessee and the nation.

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. Field crops resistant 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 economic 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): $1,970,689

Full-time Equivalents: 32.1

Key Theme: Ruminant and poultry production systems

Project Title: Improved production practices in 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, and 3) assessing three meat goat breeds for sire-progeny performance and estimating heterosis levels 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.
- Commercial meat goat production typically involves the use of fullblood sires in crossbreeding programs to produce crossbred market kids and replacement does. Understanding the comparative strengths and weaknesses of sire breeds and performance levels of various breed combinations for kid performance will enhance the ability of producers to make informed decisions in the genetic management of commercial herds

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 have been examined.

b. Impact

- Optimum crude protein and metabolizable energy for guinea fowl replacement pullets were presented and recommended to guinea fowl producers.
- Optimum crude protein and metabolizable energy for guinea fowl layers were evaluated and are now available to guinea fowl producers.
- Appropriate lighting intensity for optimum growth and egg production of the guinea fowl was established and recommended to producers.
- Growth patterns for the guinea fowl were published in the Journal of Poultry Science and serve as guideline for guinea fowl management and feeding.
- Improved management practices especially appropriate floor space allowance and feed efficiency has reduced the cost of producing guinea fowl.
- Three undergraduate students were 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 of this project is 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.
- Several genes such as the fatty acid synthase of the guinea fowl have been partially sequenced and are being used for comparative mapping of avian species.
- Three undergraduate and two graduate students were trained in animal biotechnology research. Three undergraduate students completed their independent senior research projects and demonstrated improved research skills. Two of these students have been admitted to the graduate school 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 a fast growing, diverse ethnic population in the U.S. An increase in domestic goat production, increased goat imports, and increased ethnic population indicates that prospects to promote the goat meat industry are very promising. The main goal of this study is to promote the goat industry as an alternative enterprise to supplement the income of small and limited resource farmers in Tennessee

A survey of goat producers was conducted in order to assess their needs and identify issues and concerns that should be addressed in order to promote goat industry. Results from producers survey reveals that there are not any organized markets available to market their products in Tennessee and surrounding states. Majority of producers have no choice but sell their live animals at the local auctions. Lack of competitiveness in the local goat markets is main reason for receiving low prices for their animals. These indicate opportunity to identify and develop value added activities that will increase their income and bring higher prices for their products. The survey results also identified needs for educational programs in the area of food safety, value added, animal health and parasite management, marketing skills and market information resources for goat producers. Such programs will have remarkable impact on promoting goat meat industry among small farmers. The survey also indicated that goat producers are unaware of consumers' needs, taste and preferences. It is critical for the goat meat industry to understand specific needs of different groups of consumers and establish niche markets for their products. The next focus of the project will be consumer aspects and comprehensive survey of goat consumers will be conducted in order to address those concerns and issues.

b. Impact
No impact to report at this time.

c. Source of Funds: USDA Evans-Allen

a. Scope of Impact**:** State-specific

Project Title: Promoting non-traditional alternative enterprises for small farmers

a. Small farms represent a significant proportion of the total U.S farms, and current trends in agriculture pose new challenges for their viability and survival. To meet such challenges and competition, there is a need for innovative approaches such as non-traditional and high value alternative enterprises. Several studies indicate that there is an increase in demand for specialty products including goat meat, mushrooms and organic food products. Such enterprises will provide small farms opportunities to create niche markets.
The main purpose of this study is to introduce and promote alternative enterprises as an opportunity to enhance economic and environmental sustainability and well being of small farmers. The project will also identify priority areas for future research, educational

and outreach activities which will be more effective and efficient in order to promote alternative enterprises among small farmers. Once these priority areas are identified and future programs will be designed based on these priorities. Such educational and outreach activities will be more effective and efficient in order to promote alternative enterprises among small farmers.

. Impact

- Two focus group meetings were conducted in Montgomery and Giles counties in Tennessee. Preliminary results showed that cost-benefits analysis and marketing were priority research areas, on-farm demonstrations and innovative information sources; outreach priorities and regulations/requirements and food safety were educational priorities indicated by small farmers. More focus group meetings are planned for Tennessee and North Carolina in near future.

. Source of Funds: USDA-CSREES/NRI

. Scope of Impact**:** Tennessee and North Carolina

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, improving propagation/production practices of existing plants, and 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 and Water Use Efficiency: Greenhouse experiments were conducted with controlled release fertilizers on chrysanthemum, poinsettia, and two species of ornamental grasses. Clays of various types and rates were incorporated into the rooting substrate of the ornamental grasses Japanese sweetflag (*Acorus gramineus* 'Oborozuki') and feather reed grass (*Calamagrostis acutiflora* 'Karl Foerster'). Some combinations of clay type and rate increased shoot biomass, while a noncalcined clay reduced shoot biomass of sweetflag, likely due to high soluble salt levels. With 'Prestige' poinsettia grown in a peat-based substrate amended with various clays at 10% v/v, the non-calcined product increased inflorescence number but reduced shoot biomass.

Cultivar Evaluation: Trials of poinsettias, the highest value floricultural crop in the US, were conducted again in 2005 in conjunction with Kansas State University and the University of Illinois. Approximately 90 cultivars from five major US suppliers were evaluated at each location. Cultivars that performed well in 2005 included some low vigor forms, due to ideal weather conditions. A consumer preference survey conducted as part of the 2005 poinsettia open house revealed that most participants prefer red poinsettias, some of which have been on the market for years, as well as some recently introduced cultivars.

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.

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. Linkage analysis on 111 selected AFLP markers from pollen grains produced 409 cM genetics maps of *Echinacea purpurea* 'Magnus'.

To address some of the problems facing Tennessee small farm operators and provide consumers with sources of vitamin rich vegetable, this research was conducted to identify new niche crops for use by limited resource farmers. The specific objectives of this project are: 1) to collect, analyze and identify vegetable crops with high vitamin contents 2) to develop molecular marker based characterization system for the true-to-type identification of vitamin rich breeding lines.

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 appropriate for production in the central portion of the US were identified, along with consumer preference trends for this high-value floricultural crop.
- These projects have trained three of TSU's graduate students, two in molecular biology procedures and one in greenhouse production techniques.
- 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 be available for genetic transformation to improve sensitive plant species.
- This project thus has demonstrated that the environmental inputs required in maintaining large plant fields for cross-pollinations using traditional genetic-mapping approaches can be circumvented. The completion of AFLP analyses on parent coneflower plant and that of its pollen grains in this project has demonstrated the utility of AFLP markers for *Echinacea* genetic mapping that would lead to reduction in the cost and or time for developing improved plant varieties.
- AFLP primer-pairs have been identified that were found appropriate to produce desirable polymorphism in the families of three high vitamin vegetable crops.

c. Source of Federal Funds: USDA Evans-Allen, 1890 Capacity Building Grants Program, USDA/ARS, State of Tennessee Vitamin Settlement

d. Scope of Impact: Multi-State NC, AL, KS, IL.

Key Theme: Small farm viability

Project Title: The role of diversification and cooperatives in small farm operations

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 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

- Results of a survey project will provide input for Cooperative Extension 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.
- A brochure titled "Strategies to Promote Success in Small Farm Operations" has been developed for consumer use, and is available at www.tnstate.edu/IAgER/Impacts/accomplishments.htm
- Regeneration systems for *Phox panuculata* 'Blue Boy' and 'Franz Schubert' and for *Monarda didyma* 'Marshall's Delight' have been developed; once these systems are combined with transformation with mildew resistance encoding peptides (Demegen Materials peptide genes D4E1 and D5C) these improved cultivars will be available for consumer use.

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 forest/farm landowners of Tennessee. Our initial activity on this project therefore involved the development of a database for the landowners. Compilation of data is completed for all forest and farm landowners in five Tennessee counties (Haywood, Fayette, Hardeman, Tipton and Lauderdale) with 47 to 30 percent share of minority population. A survey instrument identifying types of landowners and ownership characteristics was developed and distributed to colleagues for comments. The survey will be implemented beginning early spring. We will utilize results of the survey as basis or guide for landowners'

interviews and field data collection on forest management and other land uses having income and natural resource conservation potentials. Results of the survey and interviews will also inform training workshops for landowners and outreach personnel and determine the in-field or on-farm research and demonstration activities planned for FY 2006-2007.

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: Improving environmental quality: urban forest resources - minority and poor neighborhoods

a. Forests and tree resources affect the environment and the economic and social well being of urban and suburban communities. They affect air and water qualities, exposure to ultraviolet radiation, energy use in buildings, etc. Urban forest and tree cover can also add value to properties and create the feelings of relaxation and well being. Optimizing the beneficial effects of urban forests requires knowledge of the forests or tree cover structure and composition, and quantification of the effects and values. For Nashville, and most metropolitan cities, in the south not much is known relative to the structure and composition of urban forests or tree resources, and how they relate to quality of the environments and to the health and well being of city residents. Moreover, much of the forest and tree resources in and around minority and poor urban neighborhoods are under-managed and degraded. We proposed in our plan of work to: 1) identify groups that influence the city's urban forest resources, 2) assess attitudes of residents towards urban trees, 3) inventory and measure the forest and tree resources of select neighborhoods and, 4) ascertain the forest and tree resources effects and value.

We are working with members of the Tennessee Urban Forestry Council to help identify and prioritized urban forest research need areas for the city of Nashville. A research proposal to inventory and assess the health and benefits of Nashville's urban forest and tree resources was developed. The proposal is being revised with new insights as a council member. It will be submitted to the Tennessee Department of Agriculture Division of Forestry for funding.

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

Overview

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

Total Expenditures (Section 1445 Funds under NARETPA of 1977): $304,618

Full-time Equivalents: 4.9

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

a. To help assess the risk level associated with refrigeration of potentially hazardous foods, food safety knowledge and refrigeration practices are being evaluated. In-home interviews and refrigerator audits were completed in 100 homes in low income areas of Nashville. In addition, samples were collected from refrigerators in 98 of those homes. Meat, vegetable, and bottom compartments of each refrigerator were swabbed with a sponge for microbiological analysis. *Klebsiella pneumoniae* spp *pneumoniae*, which is known to carry antibiotic resistance genes, was the most prominent bacteria. The results show that a contaminated refrigerator can be a potential source of pathogenic bacteria which can be transferred to other parts of the kitchen. Some food borne illnesses occur because consumers have not been informed and taught about sanitation in the kitchen environment. There is a need to deliver sanitation education to consumers. The temperature of each refrigerator was checked with an infrared device, and a thermometer was installed in each refrigerator. Before leaving the home, the participant was told the temperature of the refrigerator, whether it was within desirable range or not, and was given two food safety brochures developed especially for this project.

b. Impact

- Six months after the initial contact with consumers, 89% of respondents said they read the information provided during the initial contact, Of those who reported having read the information, 97% said the information was beneficial to them, and 75% said they had made changes in their refrigeration and/or food safety practices as a result of the information provided. The most frequent changes included: cleaning the refrigerator more often and storing leftovers for shorted periods of time
- Most recently, as a direct result of some of the food safety concerns found during our in-home visits, the extension program has developed a kitchen cleanliness project to assist these limited resource consumers in better caring for their kitchens.

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

- Antibodies to *Salmonella* surface antigens have been produced; these antibodies provide valuable structural probes for detecting flagellar proteins of this microorganism. Immunoassays utilizing these antibodies have been developed for rapid detection of *Salmonella* in foods; the immunoassays will be used for screening of food contamination to reduce the risk of consumers' exposure to *Salmonella*.

.

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

- Immunoassays have been developed to study denaturation of the protein markers and their correlation to inactivation of prion protein. The developed assays will ultimately be used as analytical tools for ensuring the effectiveness of manufacturing process to inactivate prion protein.

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 models to be used for data analysis was concluded. The models are, however, still being tested and evaluated for appropriateness. Data collection will start in March 2006. Work on the sampling frame has been developed and strategies for the administration and implementation of the mail and face-to-face surveys have also been completed. After input from researchers and scientists, the questionnaire survey to be used for data collection was finalized and will be sent through the University's human subject committee for approval before use.

. 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. Efforts have been focused on increasing consumer intake of fresh fruits and vegetables. However, as consumption increases, protection from food-borne illness becomes of added importance. A comprehensive approach to developing relevant techniques for communicating food safety information included: determining consumers' fresh fruit and vegetable consumption and cleaning practices, assessing effectiveness of these cleaning methods, and developing an educational brochure. In a laboratory study, the most frequently consumed items, *i.e.* lettuce, broccoli, apples, and tomatoes, were inoculated with a test organism, then were either soaked in water, a commercial vegetable wash, lemon juice, or vinegar. Each was then either rubbed and rinsed, rinsed only, brushed and rinsed, or wiped with a wet and/or dry paper towel. Wiping apples and tomatoes with paper towels showed little bacterial reduction. Generally, water, vinegar, lemon juice, and vegetable wash solutions reduced bacteria population approximately the same amounts. Therefore, it is cost effective for consumers to use cold running tap water instead of other washing solutions to reduce microbial contamination on fresh produce.

b. Impact
- A full-color brochure was developed and printed. It was later adapted for presentation as a Web page and placed online for public access and download (http://www.tnstate.edu/iager/impacts/eating_fruits.htm) . A link was placed on the Web page to allow visitors to order printed copies of the brochure. A brief survey requesting information on the visitors' background, opinion of the web materials, and intended use of the brochure was included. To date orders for brochures have been for individual use and for use by nutrition educators in classes.

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. Contacts for possible cooperation with Alabama A&M University, the University of Tennessee, North Carolina A&T State University, the University of Arkansas at Pine Bluff, Kansas State University and Triangle Research Institute were finalized. A nutritionist from Tuskegee University was contacted and she agreed to collaborate on any future research with a nutritional component. Some understanding and verbal commitments were reached in principle that, if needed, scientists will collaborate in working together to re-submit a revised project based on the bridge grant awarded to Tennessee State University. Highlights of the bridge grant was discussed at the Morro Bay Food Distribution Research Society (FDRS) meeting reported in the first year of the project. Further discussion and some highlights of the developed survey were discussed at the FDRS meeting in Washington, DC in October 2005. A fully-developed survey questionnaire was completed and reviewed by project director, co-director and other scientists. The completed questionnaire will be available for use in revised proposal.

.

b. Impact

- The project helped in building a strong relationship for future collaborations with six other land grant universities increasing the probability of developing and re-submitting a project based on the bridge grant just ended.
- Students on the project continued to improve their computer skills through training received while working on the project. Training included using statistical software and spreadsheet programs for data entry and analysis.

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. Listeriosis, an infection caused by *Listeria monocytogenes (Lm),* is a potentially fatal disease of major concern. The *Lm* risk assessment conducted by FDA and FSIS showed that keeping refrigerated foods such as smoked seafood and ready-to-eat (RTE) meats at 40°F or lower and using refrigerated RTE foods as soon as possible can reduce consumers' risk of illness from *Lm* by more than 50 %. To characterize consumer storage practices for refrigerated RTE foods, a nationally representative Web-enabled survey of pregnant women (n = 249), seniors (n = 946), and the remaining population (n = 865) was conducted. The survey collected information on refrigerator temperatures and storage time for bagged salads, pre-cut fresh fruit, pre-cut fresh vegetables,

frankfurters, and vacuum-packed luncheon meats. Reported temperatures and storage times for unopened and opened packages were compared to USDA/FDA temperature and storage time guidelines. Older adults, white, non-Hispanic respondents, respondents not living alone, and respondents with lower incomes were more likely to have a refrigerator thermometer ($p < 0.05$). Older adults (71%) were more likely than pregnant women (62%) and the remaining population (64%) to have their refrigerators at the recommended temperature ($p < 0.05$). Most respondents (>95%) stored unopened packages of RTE foods for the recommended time or less. Most respondents stored opened packages of bagged salads, pre-cut fresh fruit, and frankfurters for the recommended time or less; however, one-third or more stored pre-cut fresh vegetables and vacuum-packed luncheon meats for longer than the recommended time. The survey also collected information on refrigerator storage time for smoked seafood, cooked crustaceans, soft cheeses, freshly-sliced deli meats, and deli salads. For these products, we compared respondents' total storage time (unopened and opened) to USDA/FDA storage time guidelines. Most respondents stored smoked seafood for the recommended time or less; however, about one-third of respondents stored cooked crustaceans and deli salads for longer than the recommended time and about one-half stored freshly-sliced deli meats and soft cheeses for longer than the recommended time. For some products, pregnant women were more likely to store the products outside the storage time guidelines and seniors were more likely to store products within the guidelines. Following completion of the web-enhanced survey, each participant was mailed a copy of the USDA/FDA food storage guidelines. Currently, face-to-face interviews are being conducted with consumers in four targeted states to obtain more in-depth information on purchasing and storage practices.

b. Impact

- Only 11 percent of all respondents had a thermometer in their refrigerator prior to the survey. All participants were mailed a thermometer to use for this project, thus over 2500 households now have a thermometer in their refrigerator.

c. 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 areas in which the Institute of Agricultural and Environmental Research Food Safety, Nutrition, and Family Well-Being Research Team are focusing their efforts. 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): $453,818

Full-time Equivalents: 7.3

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

a. This program focuses 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. Following four surveys that assessed food security status, purchasing practices and dietary status, discussion groups were conducted with limited resource individuals to gain further insight into the reasons for the food selections that were made, and factors that might positively influence those selections. The majority of the consumers studied made several unwise choices with the limited funds they had at their disposal, regardless of whether those funds were from government assistance programs or not. Although most of the consumers studied had a good understanding of what constitutes a balanced diet, they did not always purchase the foods to attain that goal, or sometimes felt that they did not have the means to do so. Thus, results indicate that food and money management education is needed for all limited resource individuals.

b. Impact

- During the discussion groups participants were introduced to recipes incorporating foods they were not familiar with, and were provided a sample of the prepared foods. All but one participant liked the foods, and reported that they would use the recipes in the future. Thus it appears that there is a willingness to try new foods that could lead to a more nutritious diet.

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

b. Impact
No impact to report at this time.

c. Source of Federal Funds: Southern Rural Development Center

d. Scope of Project : Tennessee, North Carolina and Alabama

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

a. The overall goal of this research 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 assess means by which consumers could be encouraged to consume greater amounts of fruits and vegetables. Most recently, a grocery store inventory was conducted to see if lack of availability was a barrier to consumption by persons living in low-income areas. In-person surveys were conducted at fifty stores that were within a one mile radius of five food banks to see which fruits and vegetables were available in each, and the quality of those items that were present. This survey included any store that was listed as a grocery store in a computer database, regardless of the size of the store. A large percentage of the stores had no fresh fruits or vegetables available. Most sold canned items, while only a few had frozen fruits or vegetables. The fresh fruits that were most often available included apples, bananas and lemons. Lettuce and cabbage were the most commonly available fresh vegetables. The variety of canned items was greater, with green beans being the mostly widely available. It is concluded that more fresh produce should be offered in stores that are in areas of easy accessibility to low income neighborhoods. It is also recommended that a follow-up study be done to compare the prices of the items available, and whether increasing their presence in the local grocery stores leads to increased consumption.

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 research, and investigates methods for increasing participation. It has three phases. In Phase I, three focus groups were conducted to determine the consumer's knowledge of health, perception of health and well-being, and the practice of prevention. Persons from three different population groups in Middle Tennessee (African Americans, limited resource consumers, and Hispanics were asked to give opinions addressing the following subject areas: health-related program perceptions, preventive practices, perception of where statistics that are seen, read, or heard about in the media come from, knowledge of different types of research, and barriers to consumer health-related research. The information gathered from the focus groups conducted in Phase I was then used in Phase II. A set of five questions concerning health practices and consumer research participation has been developed, tested and added to each of the research projects conducted by the Food Safety and Nutrition Team of IAgER. Phase III is an expansion of Phases I and II where there will be focus groups conducted with economically advantaged groups (for comparison), an expanded questionnaire, and investigating methods for increasing participation. Results will be used to design more effective methods of recruiting and including minority populations in nutrition and health studies.

b. Impact

- Information about our project reached the Hispanic community and we were asked to join the Nashville Latino Health Coalition, and serve on the committees to improve health services to this population.

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

a. Estimating what one ate is difficult, especially if you do not know you are going to 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 for some persons. Thus, the purpose of this study is to investigate whether a more simplified method can be used for reporting such data, one using descriptive size terms. Three separate studies were conducted to assess different scale lengths and their usage with various foods. There were no significant differences between the responses of those persons using the three different scales in study one. All scales were reported as easy to use, adequate in length, easy to understand, and appropriate for use with most foods. However, the responses for each food were more consistent when using the three and five point scales than when using the

10 point scale, where responses were scattered across the range of choices in several cases. When using the three-word scale, responses clustered around the "medium" choice. Respondents were also asked whether they preferred using the word scale to reporting the size by another method such as cups, ounces, or inches. The overwhelming majority (98%) preferred using the word scale. Thus, respondents preferred using word scales over reporting portion sizes using traditional methods. They did not have a preference for the length of the scale or the words that were used. However, the terms used to report the size of the various foods were more consistent when using the three and five word scales. A second study included meat of various types and sizes, two descriptive term scales and a ruler, where linear regressions for both a five and seven point scale were similar. When given the additional choices for the seven point scale, persons were likely to split their response for a category between the two options. For example, if a large percentage chose "very small" when using the five term scale, they chose either "extra small" or "very small" when using the seven point scale. The respondents reported that the five and seven term scales were both easy to use, and could be used for almost all foods. A larger percentage found the ruler to be more difficult to use. In addition, the size data obtained by using the ruler varied greatly, and the reported measures were inaccurate. Thus, the use of a descriptive size term for portions of meat does appear to be a consistent choice when obtaining dietary records and recall information. Significant differences were not found between the descriptive portion sizes reported by the overweight or healthy weight subjects, nor were there any differences in the distribution of what they said was a normal portion size for them. The few differences that were found actually showed that the overweight individuals thought the amount shown was a larger portion size than did healthy weight persons. This information is important to nutritionists who counsel patients because it suggests that differences in perception of portion size are probably not the problem, thus other factors must be addressed and emphasized. More total foods, more eating occasions, a sedentary lifestyle, or a cognitive "disconnect" between the actual and perceived sizes of portions consumed may be more important issues in the obesity epidemic. In conclusion, consumers liked using the word scales and preferred that style of reporting rather than reporting by more traditional methods *i.e*. cups, ounces, ruler, etc. Thus using scales does appear to be a viable method that can be used with some consistency in reporting dietary intakes. Improved efficiency and accuracy in dietary assessment could reduce the burden of recalling amounts eaten on both the client and the interviewer.

b. Impact

- It is anticipated that the three point scale currently used for reporting amounts eaten will be altered after completion of this project.

c. Source of Federal Funds – USDA Capacity Building

d. Scope of Project: Tennessee and Kansas

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

a. The goal of this combination of 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 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. Additionally, over-reliance on synthetic fertilizers in crop production can result in migration of nutrients into water resources. Finally, animal farming operations can contribute to nutrient and pathogen pollution of water. Potential adverse impacts of pesticides, nutrients and pathogens on human and ecological health call for studies on fate, behavior, and mitigating strategies for undesirable intrusions of chemical and pathogen in soil and water. Researchers on IAgER's Environmental Protection and Enhancement Team are directing their research efforts toward identification and implementation of alternative pest and disease control; strategies for remediation and/or mitigation of adverse impacts of agricultural non-point source pollution, and overall resource management approaches for environmental protection and enhancement.

Total Expenditures (Section 1445 Funds under NARETPA of 1977): $1,722,022

Full-time Equivalents: 27.7

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 insecticide treatments demonstrating potential for inclusion in the Harmonization Plan include clothianidin and thiamethoxam.
- 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 accurate collect buprestid borers; these traps are being tested and developed for monitoring of emerald ash borer, a serious exotic beetle now threatening the entire U.S. ash resource.

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

. Adsorption of triclopyr on diverse soils was sought to be studied utilizing the batch adsorption technique. Factors affecting triclopyr adsorption included: soil type, time, herbicide concentration and pH. Equilibrium time for triclopyr adsorption was about 10 hours, regardless of soil type and herbicide concentration 0.1 to 1 ppm). Organic matter was positively correlated with herbicide adsorption.

a. Impact

- Improved method of triclopyr extraction from soils and fortified waters was developed. This method is less time consuming, and eliminates the 'cleanup' step before gas chromatographic chemical analyses. Thus, it improves the efficiency and safety of the chemical analysis technique of this herbicide.

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. An *in situ* field survey of EC_a plays a major role in precision agriculture. Growers can tell which block(s) of their nursery field is high or low in soluble salts. The accumulation of soluble salts in nursery fields can adversely impact crop growth by increasing osmotic potential of the soil solution and subsequently may induce specific ion toxicities or nutrient imbalance.
The goal of the research is to monitor nursery soils salinity level as a function of apparent soil electrical conductivity (EC_a). Four nursery fields in Middle Tennessee are being used for the study. The sites are geo-referenced and the shape files will be linked to ArcCatalog of an ARCView platform. Soil samples from the nursery fields are also being analyzed for predominate solutes responsible for salinity.

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: 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. Between 2004 and 2005, we investigated four grasses namely, Eastern gammagrass (*Tripsacum dactyloides*), switchgrass (*Panicum virgatum*), Indian grass (*Sorghastrum nutans*) and big blue stem (*Andropogon gerardii*), and 2 legumes, namely alfalfa (*Medicago sativa*) and crown vetch (*Coronilla varia*) to determine their abilities to enhance dissipation of the insecticides dursban (*chlorpyrifos*), flagship (*thiamethoxam*), talstar (*bifenthrin*), and chlordane. Dursban is widely used as a quarantine insecticide to control the Japanese beetle in nursery production; however, growing concerns about the chemical's human and ecological impacts suggest that its future use could be restricted. Accordingly, alternatives are being sought as replacement. Among the alternatives being tested are flagship (thiamethoxam) a neonicotinoid insecticide and talstar (bifenthrin) a synthetic pyrethroid. 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 Tennessee sediments.

   We observed different behaviors of the insecticides under the influence of different rhizospheres. We are studying the microbiological characteristics of the soils to identify plant-microbe interactions that cause accelerated degradation of insecticides in rhizospheres, so they could be improved further. We have used biochemical approaches and are continuing to develop molecular ones for characterizing soil microbial communities. Laboratory personnel and students were trained in current methods for chemical, microbiological, and molecular analysis of soil.

b. Impact

- Students received training in current methods of environmental analysis; this will open career opportunities in an area where minorities are underrepresented.
- Laboratory personnel acquired skills in chemical, microbiological and molecular analysis of soils. This acquisition opens the door for advanced work on environmental analysis within the Institute.
- Implementation of phytoremediation practices in the field will provide an environmentally more desirable method for cleaning up or mitigating adverse impacts of agrichemicals in the environment.

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 impacts to report at this time.

c. Source of Federal Funds: USDA Evans-Allen

d. Scope of Impact: State Specific

Key Theme: Global information systems

a. Geographic Information Systems (GIS) is a computer-based tool with capabilities of inputting, storing, manipulating, and presenting geographically referenced data. At present, it is one of the most useful tools available for analyzing complex geographic data. GIS is fast becoming an indispensable tool for decision-making in the management of natural resources. The goal of this project is to produce a core of agricultural researchers and faculty at Tennessee State University in tune with an advanced approach to presenting and solving agricultural problems.

b. Impact

- A permanent GIS training and research lab was established. Twenty-two faculty and staff completed basic training and six completed advanced training in GIS applications. A Natural Resources Conservation Service GIS training workshop was hosted by TSU, with certificates of completion awarded to 20 NRCS and TSU employees. A website for the recently formed National GIS/GPS Integration Team was developed and is being hosted by the Cooperative Agricultural Research Program.

c. Source of Federal Funds: 1890 Capacity Building Grants Program

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 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): $708,702

Full-time Equivalents: 11.4

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.

After input from researchers and scientists, the questionnaire survey to be used for data collection was finalized and will be sent through the University's human subject committee for approval before use. Data collection began in March 2006. The sampling frame has been developed and a strategy for the administration and implementation of the mail surveys has also been completed. Work on the models to be used for data analysis was concluded; however, the models are still being tested and evaluated for appropriateness and robustness.

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 nursery producers 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: 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.

During this report period, a survey questionnaire developed by collaborating institutions for the project during the first year was discussed among team members and modified according to suggestions. Telephone data on food safety knowledge, opinions, and actual practices were collected from 1,000 randomly selected residents of Alabama, North Carolina and Tennessee. Demographic information was also collected. Scientists and students worked together on coding, entry and analysis of data collected up to this point. Updated statistical software for data analysis was acquired.

b. Impact:

- Students on the project were introduced to data management and analysis using the Statistical Package for the Social Sciences (SPSS) and Micrsoft Excel. These students acquired some basic skills in data coding, data entry, and data analysis using the above-referenced software packages. Students also received training in poster design and preparation.

c. Source of Federal funds: USDA/SCREES 1890 Capacity Building Grants Program

d. Scope of Impact: Multi-State Research – TN, AL, NC

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

- Approximately 75 high school teachers have been trained in applied biotechnology techniques. The training enhances the knowledge and confidence of the teachers to teach the subject in their schools. Five undergraduate students have been trained as interns during the summer of 2005; as a result of the training they received, two of the students are currently pursuing graduate degrees in biotechnology. A small number of area high school students interned in IAgER laboratories and received hands-on training in plant biotechnology.

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 (http://www.tnstate.edu/IAgER/Impacts/accomplishments.htm) 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. generally and in the southern states particularly. This rapidly growing population is characterized by high poverty rates among children and elderly population compared to other races. 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 help to identify problems 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 representatives from small, medium and large nursery operations 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) seek stakeholder input through professional meetings, field days, demonstrations, consultations, and informal contacts. This input is 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 are 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.

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 Sate 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.