

PLAN OF WORK

Annual Report of Accomplishments and Results

Cooperative Agricultural Research
Program

Tennessee State University
Tennessee 1890 Land Grant
University

Federal Fiscal Year 2001

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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 and considering non-traditional livestock. Research at Tennessee State University is addressing issues concerning the 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. Beef cattle and chickens are represented in research activities on traditional livestock. Key aims of the animal research are: 1) assessing metabolic indices in cattle exposed to ergot alkaloids of endophytic tall fescue to identify mechanisms of fescue toxicosis, 2) determining the effects of vitamin E supplementation on beef cow-calf performance, 3) evaluating management practices for improved production efficiency in guinea fowl, and 4) developing a competitive meat goat production system for limited resource farmers in Tennessee as an alternative to cattle, tobacco, and other 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 for the introduction of selected alternative, improved plants for small farmers in Tennessee to be utilized as alternatives to tobacco farming and other farming activities for which they are losing or are likely to lose market share. 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 *Hypericum* species have a range of medicinally

important qualities, such as antibacterial, antidepressant and anti-inflammatory effects. Consequently, propagation and cultivation 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 these owners. Among the reasons that have been attributed to this condition is the lack of sustainable forest management knowledge among these owners. 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 empower them to generate more income from their lands. This effort is in an early stage of development. We are working to build the capacity necessary to address this very important issue. Future annual reports will include information outcomes of our efforts on this subject.

Total Expenditures (Section 1445 Funds under NARETPA of 1977) - \$1,091,100

Full-time Equivalents - 20.3

Key Theme - Ruminant and Poultry Production Systems

- a. This program is focused on developing competitive animal production systems for limited resource farmers in Tennessee and in the surrounding states. Research is designed to improve production efficiency in beef cattle enterprises and develop management programs for alternative livestock species (i.e., guinea fowl and meat goats). Four key objectives are: 1) assessing profiles of blood constituents for possible metabolic disruptions in cattle exposed to ergot alkaloids linked to fescue toxicosis, 2) determining the effects of vitamin E supplementation on reproductive performance in beef cows, 3) characterizing management techniques for optimal performance of caged guinea fowl, and 4) developing a meat goat management program that would be profitable for limited resource producers. A meat goat research herd is being established at TSU to study various components (e.g., genetics, nutrition, reproduction) of a comprehensive goat production system with the intent of generating management recommendations for participants in Tennessee's growing goat meat industry.
- b. Discoveries/ Impacts
 - Acute exposure of cows to ergotamine, an ergot alkaloid associated with tall fescue endophyte, alters the plasma concentrations of glucose, non-esterified fatty acids, cholesterol, urea nitrogen and insulin-like growth factor-I. Brahman and Hereford steers were similarly responsive to ergotamine in terms of metabolic hormones and glucose, except that heat-tolerant Brahman did not have thyroid hormone or respiratory responses.

Hereford steers chronically exposed to endophyte-infected tall fescue had reduced plasma insulin and increase thyroid hormone that correspond with cattle responses to ergotamine. Furthermore, plasma glucagon, non-esterified fatty acid and cholesterol were altered by diet. Shifts in metabolic function may contribute to lost performance in cattle grazing endophytic fescue.

- Treating beef cows with injections of vitamin E before and after summer breeding did not alter pregnancy rates, calving rates, or calf birth weights. Vitamin E injection cannot be viewed as a viable means of improving cow-calf reproductive performance based on the results of this project.
- Increased cage density for guinea fowl hens from one to three birds per cage reduced estimated cage performance for egg production, but did not alter hen weight gain or mortality rates. Results may lead to floor space recommendations to enhanced caged guinea fowl productivity. As part of the guinea fowl research effort, the research program hosted the annual meeting of the Guinea Fowl Breeders Association. The event facilitated communication between the guinea fowl producers and the research staff on areas of concern relative to guinea fowl management.
- A survey of goat producers in Tennessee was conducted that indicate areas of concern for the Tennessee meat goat industry. The biggest problem areas indicated by the 205 survey respondents were: 1) control of internal parasites, 2) marketing of live goats, and 3) marketing of chevon products. Aspects of reproductive, nutritional, genetic, and general management in goat operations were also learned from the survey as presented and discussed at the annual meeting of the Tennessee Goat Producers Association. Survey results will aid the University in developing relevant research projects to enhance meat goat production in Tennessee.

c. Source of Federal Funds: USDA Evans-Allen

d. Scope of Impact: State Specific

Key Theme - Nursery Crop/Green Industry Enhancement

- a. Scientists have developed a plan to improve selected plant genera to broaden their consumer appeal and contribute to the enhancement of Tennessee's standing as a national leader in the nursery industry. This goal also includes the development of hands-on teaching and demonstration areas on the CARP research farm in Nashville. The demonstration areas will strengthen teaching and stimulate interest in the plant sciences among local high school students and other clients, and to transfer new discoveries to limited resource nursery owners.

Among the genera targeted by the team for improvement are *Helleborus*, *Pulmonaria*, *Hemerocallis*, *Castanea* and *Ulmus*. Improvement of these crops will be in development of new cultivars and improvements in propagation practices. Accomplishments in this area include generic transformation and regeneration of *Ulmus* and *Hemerocallis*, progress toward a better-defined formula for *Helleborus* seed germination, completion of the first step in micropropagation of *Pulmonaria*, defining DNA markers for efficient breeding of *Helleborus* and *Pulmonaria*, and refinement of the *Castanea* collection.

Production studies with containerized *Helleborus* and *Pulmonaria* examined the uptake of nutrients delivered by different brand and formulations of fertilizers, and also examined the balance between fertilizer rates for optimal growth and rates for optimal nutrient uptake. Data revealed that shoot biomass increased with increasing rate of controlled release fertilizers (up to 2 g nitrogen/container). However, as fertilizer rate increased, electrical conductivity of container leachate also increased, suggesting that nutrient uptake was inefficient at higher fertilization rates. Uptake of nutrients was more efficient with the Polyon product than the Osmocote product. High fertilization rates decreased pH of container leachate. Results suggest that relatively high rates of fertilization are required to maximize growth of these species.

The focus of teaching and demonstration plots have been identified; these areas will include tree fruits (peaches, apples, pears), vine fruits (grapes), small fruits (strawberries, blackberries, raspberries), turf plots, nursery plants and other plants to be added in the future. To date the plan of the demonstration area has been finalized and crepe myrtle and *Nandina* plots are established. A professional drawing of the farm/plots has been completed.

Applied research in areas suggested directly by growers included examination of propagation strategies for niche ornamentals, use of alternative substrates of nursery crop growth and expert, unbiased evaluation of nursery production products.

b. Discoveries/ Impacts

- DNA analysis was used to determine the species identity of a popular commercial cultivar ('Roy Davidson') in the genus *Pulmonaria*. This determination is necessary for efficient development of improved cultivars utilizing desirable traits of 'Roy Davidson'.
- A protocol for the genetic transformation and regeneration of daylily (*Hemerocallis* hybrid) was developed. The development of this protocol is a crucial first step to the application of genetic engineering technologies to *Hemerocallis* improvement.
- A protocol for the genetic transformation and regeneration of Chinese elm (*Ulmus parvifolia* Jacq.) was reported. This system can be used to apply genetic engineering technologies to elm improvement programs. In the present program it will be used to confer disease resistance to the Chinese elm.
- Optimal fertilizer rates and formulation for maximum growth and minimal waste for *Helleborus* and *Pulmonaria* were determined. Determination of these rates will enable producers to reduce cost of production while safeguarding the environment against excessive nutrient contamination.
- A comparison of propagation heating mats determined which brand of mat maintains temperature within tolerances for efficient plant propagation. These finding will improve efficiency of the nursery industry by informing growers about which products do not perform in a suitable manner.

c. Source of Federal Funds: USDA Evans-Allen, 1890 Capacity Building Grants Program.

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. Discoveries/ Impacts

- A permanent GIS training and research lab was established. Investigators began basic and advanced training in GIS applications. 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

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, CARP 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.

A survey instrument was designed and pre-tested before being mailed to two hundred randomly selected small farmers in Middle and West Tennessee counties. Seventy-nine completed responses, representing forty percent response rates, were received. A presentation titled "Targeted Research, Education and Outreach for Small Farmers" was made at the Professional Agricultural Workers Conference (PAWC) in December 2001 at Tuskegee University. It was based on a set of questions in the survey focusing on research, education and outreach needs of small farmers. The key stakeholders present at the meeting included researchers and students from land grant universities, extension specialists, various USDA agency personnel from the CSREES, NRCS, FSA, ERS working on small farm issues, grass root non-profit organization such as Federation of Southern Cooperatives, Rural Coalition and Community Based Organizations.

b. Discoveries/ Impacts:

- Molecular markers (AFLP) were developed for eleven species and cultivars of *Hypericum*. These markers were correlated to the presence of various pharmaceutically active metabolites in the plants to develop suitable candidates for marker-assisted selection strategies for breeding high-metabolite hypericums.
- Analysis of various in vitro regeneration schemes found inter-specific differences in the genus *Hypericum*. These findings will assist in developing a regeneration system for species other than *H. perforatum* with the ultimate objective of producing superior cultivars that contain increased amount of pharmaceutical products.

- A protocol was developed to amplify DNA from individual pollen grains of Echinacea. This technique has direct applicability to the development of genetic maps of his genus ant a lower cost than traditional methods.
- In addition to presentation of results on research, education and outreach needs from the farmers' perspective to the diverse stakeholders indicated above, the survey instrument used was shared with USDA/ERS researchers. Some of the survey questions may be included in the upcoming annual Agriculture Resource Management Survey (ARMS). All of the above are expected to bolster efforts to assist small farmers at various levels.

c. Source of Federal Funds: USDA Evans-Allen, 1890 Capacity Building Grants Program

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 Cooperative Agricultural Research Program's 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 before the consumption of raw fruits and vegetables, and reducing exposure to food contaminants.

Total Expenditures (Section 1445 Funds under NARETPA of 1977) - \$105,796

Full-time Equivalents - 2.4

Key Theme - Bacteria in Fruits and Vegetables

- a. An increased intake of raw fruits and vegetables is being promoted by many groups as a way to reduce the incidence of many food-borne diseases. Examples of these include various types of cancer (colon, breast and prostate) and heart disease. Fresh fruits and vegetables carry many pathogens; thus an increased intake of them, if not prepared properly, may result in an increased incidence of food-borne illnesses. Thus, the goal of this research is to determine which fruits and vegetables consumers are eating most frequently in the raw form, what they are doing to them before consumption, and how effective these treatments are in reducing the bacterial load before the fruit/vegetable is eaten.
- b. Discoveries/ Impacts:
 - Most of the respondents wash their produce before eating it raw; however this was more common for those where the peel was not going to be removed. Since the bacteria are on the outer surface that comes in contact with the hands, then the flesh of the fruit/vegetable, consumers need to increase the frequency with which they wash and scrub all produce.
 - Although washing removes some of the bacteria, more is removed through rubbing and scrubbing. Commercially prepared solutions are not being used by the majority of the consumers because of the added expense incurred when using them.

c. Source of Federal Funds: USDA Evans-Allen

d. Scope of Project: State Specific

Key Theme - Salmonella in Poultry

a. One of the major causes of food-borne illness in the United States is salmonella. Many mechanisms for control of these organisms have been developed and studied, however bacteria are becoming more resistant to treatments. This research is being conducted to identify proteins that are being expressed in salmonella as the result of exposure to stress conditions and define the mechanism for enhanced resistance after exposure to various stressors.

b. Discoveries/ Impacts:

- Two-dimensional gels show a different protein pattern for the various stressors. Antibodies to various known stress proteins have been used in Western hybridization analysis. Positive results have been identified with dnak, groEL and hsp60. Other antibodies that did not produce positive results included hsp70 and hsp65. The stressors that *Salmonella* are exposed to in the laboratory are similar to those that the bacteria encounter in the environment. Some of the stress proteins may be protective for the bacteria and lead to enhanced pathogenicity or virulence. Through understanding the molecular mechanism responsible for induction of the stress proteins, inactivation inhibitors may be designed to be used in the food industry or to make vaccines.

c. Source of Federal Funds: USDA Evans-Allen

d. Scope of Project: State Specific

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 Cooperative Agricultural Research Program's 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) – \$46,984

Full-time Equivalents - 2.3

Key Theme - Nutrition Education for Disadvantaged Populations

- 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 food box recipients. The overall goal is to improve the food security status and dietary intake through increased access to knowledge and food sources.
- b. Discoveries/ Impacts
 - Although almost half of the respondents in the study were rated as food insecure, no relationship was found between food security status and nutrient intake. Almost everyone in the study met the minimum requirements for most nutrients. Intakes were similar to the general population findings reported in the Continuing Survey of Food Intake by Individuals (USDA) and the Health and Nutrition Examination Survey (DHHS).
 - In this study The Food Security Scale did not serve as a valid predictor of dietary intake of the participants. This Scale may need revision, or additional measurement techniques that are better predictors of nutritional status may need to be developed.
 - Level of nutrition knowledge also did not correlate with dietary intake. Knowledge alone does not improve nutrition status. Thus creative approaches for changing dietary habits are needed.
- c. Source of Federal Funds: USDA Evans-Allen
- d. Scope of Project: State Specific

Key Theme - Healthier Eating Through Increased Fruit and Vegetable Consumption

- a. This program 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, and preparation methods were investigated. 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.
- b. Discoveries/ Impacts
 - Fruit intake averaged less than one serving per person per day, with over half of the population studied not consuming any fruits. Orange juice was the most popular fruit product. Vegetable consumption was slightly higher, although still well below the recommended three servings a day. Tomatoes and onions were the most frequently consumed vegetables.
 - Perceived fruit and vegetable recommendations did not correlate with amounts consumed. Most people thought they needed many more servings each day than they consumed. Thus, it is doubtful that nutrition education itself would improve intake. Innovative ways of incorporating fruits and vegetables into the diet are needed.
- c. Source of Federal Funds: USDA Evans-Allen
- d. Scope of Project: State Specific

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. CARP'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) - \$295,718

Full-time Equivalents - 7.3

Key Theme - Integrated Pest Management; Improving Environmental Quality

- a. Our research efforts have included the following: 1) The evaluation of Japanese beetle 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) The evaluation and development of environmentally friendly alternatives to fungicides for powdery mildew disease management in dogwood production.
- b. Discoveries/ Impacts:
 - In field insecticide and nematode trials, Japanese beetle larvae were significantly reduced by imidacloprid, halofenozide, thiamethoxam, and trichlorfon. Entomopathogenic nematodes were ineffective at controlling larval Japanese beetle in this study. Irrigation of products immediately after treatment did not enhance product efficacy. New generation chemicals (*e.g.* neonicotinyl products like imidacloprid and thiamethoxam; halofenozide) being used for Japanese beetle control had minimal impact on *Tiphia* survival. Older carbamate and organophosphate chemistries (*e.g.* carbaryl and chlorpyrifos) were detrimental. Field surveys for *T. vernalis* parasitized grubs demonstrated very low incidence of the parasite in middle Tennessee nurseries. In insecticide dip studies for Japanese beetle control, grubs were completely eliminated from 24-inch root balls with high clay content with chlorpyrifos at 0.125, 0.5, and 1 lb ai/100 gallons. Products completely eliminating third instar Japanese beetle larvae from artificially infested root balls included chlorpyrifos, carbaryl, trichlorfon, bifenthrin, imidacloprid, halofenozide, and thiamethoxam.

- Soil moisture levels below 3% of field capacity were found to inhibit the movements of *Steinernema carpocapsae* and *Heterodera glycines*. Nematode activity was not affected by soil temperatures below 41°C, but a total cessation of *S. carpocapsae* infectivity occurred at 41°C, and both *S. carpocapsae* and *H. glycines* ceased all activity at 44°C. Maximum dispersal in sand columns was found at pH levels of 7.0-8.0 for *S. carpocapsae*, and at pH levels of 5.5-7.0 for *H. glycines*. Isolated and interactive locomotory behaviors of *S. carpocapsae* and *H. glycines* were significantly influenced by host presence/absence and by environmental cues. The movement of nematode eggs was found to be facilitated significantly by the movement of water through sand columns, indicating that the spread of both *S. carpocapsae* and *H. glycines* may be facilitated by the movement of water through the soil.
- Powdery mildew resistance has been identified from plants generated from open pollinated seeds. Twelve plants are targeted to serve as sources of new cultivars resistant to powdery mildew. Four Biorational compounds that can be used as alternatives to traditional fungicides in powdery mildew control have been identified. The effect of those products either individually or in rotation with traditional fungicides was demonstrated to growers during the Tennessee Green Industry Field Day. In evaluations of microbial populations on dogwood, yeasts, fungi, and bacteria have been isolated, and their potential in powdery mildew control is currently being evaluated.

c. Source of Federal Funds: USDA Evans-Allen; CSREES 1890 Capacity Building Grants

Other Sources of funding: Tennessee State University/State of Tennessee

d. Scope of Impact: State Specific

Key Theme - Sustainable Agriculture

- a. Adsorption and desorption of five widely used pesticides will be studied utilizing both batch technique and column of soil materials. Soils from various nursery sites ranging widely in pH, organic matter and soil texture, as well as various soil mixes and soil separates will be included. Soil mixes and commercially obtained soil separates will also be included. In batch studies, the factors affecting pesticide adsorption-desorption will 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 will be conducted at various pesticide concentrations, and different water fluxes. Applicability of a mathematical model, based on chromatographic theory to predict pesticide movement, will be tested.
- b. Discoveries/ Impacts:
A modification of an existing micro-extraction technique worked very well for the determination of oxyfluorfen in drinking water as well as surface run-off water. Extraction of oxyfluorfen from soil with acetonitrile, and direct examination of the

solvent extract by gas-liquid chromatography represent a considerable time savings as compared with other labor intensive methods involving extraction and clean-up.

c. Source of Federal Funds: USDA Evans-Allen

d. Scope of Impact: State Specific

Key Theme - Water Quality

a. The overall goal of this research is to explore the potential use of wood fibers as best management practice (BMP) for the production of nursery crops. This study will characterize (physically and chemically) three types of wood fibers and determine their adsorption capacities for two pesticides. The transport of these pesticides in columns of the selected wood fibers will be determined. Breakthrough curves will be used to determine flow parameters. A total mass balance for the applied pesticides will be performed. Additionally the fractions of pesticides sampled from each column will be predicted using a convective-dispersive type equation.

b. Discoveries/ Impacts:

- Average organic carbon was determined to be 35.84% for pine bark wood fiber used in a herbicide transport experiment and 31.12% for hardwood fiber. Calibration of the concentration of Simazine was completed and an application of 19.3 kg ha^{-1} Simazine (46 kg ha^{-1} Princep 4L) was uniformly applied to the surface of the soil columns with and without pine bark wood fibers. The peak concentration of Simazine leached after two pore volumes of water drained from soil columns treated with pine bark wood fiber was 11.86 kg ha^{-1} and 16.01 kg ha^{-1} in columns without pine bark wood fiber. Leaching condition was a saturated flow. Water flux was 0.8 cm hr^{-1} and was under steady state condition.

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) - \$320,562

Full-time Equivalents - 3.6

Key Theme - Economic Opportunity Enhancement

- 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 will discuss the structure and the economic contributions of the industry to the economy of the state are in preparation. 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. Discoveries/ Impacts:
- Grant funds made available to Tennessee State University has helped expand the computer skills of researchers in the University and strengthened collaborations between research units in the Cooperative Agricultural Research Program. Students working with researchers on the project have improved their computer, writing and communication skills. Using some of the secondary data collected as part of this project, researchers from Tennessee State University attended and presented three papers at the Southern Nursery Association in Atlanta, Georgia in August 2001. These papers are published in the 2001 SNA Research Proceedings (Vol. 46).

c. Source of Federal Funds: USDA Evans-Allen

d. Scope of Impact: Multi-State AL, MS

Key Theme - Economic Opportunity Enhancement

- 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 covered in this report, the subcontracts for collaborating universities were completed. Data collection for the project will now proceed for all states. Completing the subcontracts allowed for project funds to be made available to collaborating institutions to proceed with data collection.

A meeting of all collaborators was held to identify all sectors and industries to be included in the three-state study. Currently, a list of businesses to participate in the survey is being developed. The final questionnaire to be used in collecting information from manufacturing businesses will be mailed to be selected participants. The advisory role of Southern Rural Development Center, and the Mississippi Rural Development Council are strengthened under this project. This project will provide useful information on the importance of agriculture and manufacturing to the economies of rural areas in Tennessee, Alabama, and Mississippi.

Using some of the secondary data collected as part of this project, researchers from Tennessee State University attended and presented a paper at the Southern Agricultural Economics Association meeting held in Fort Worth, Texas in January 2001. Information and software obtained from our attendance at the IMPLAN workshop organized by the US Forest Service is currently being used in generating preliminary IMPLAN estimates for Tennessee. Progress is also being made in finding ways of generating similar estimates for Mississippi and Alabama.

- b. Discoveries/ Impacts:
- Grant funds made available to Tennessee State University has helped expand the skills of researchers from the University and strengthened collaborations between the ERS, the US Forest Service and collaborating institutions. A second data analyses training workshop will advance the skills that were acquired in the first training workshop. An abstract was published in the Journal of Agricultural and Applied Economics, Volume 33, Number 3. Students have improved their computer skills from working on analyzing the secondary data collected for the project.

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

d. Scope of Impact: Multistate Research with AL and MS

Key Theme - Economic Opportunity Enhancement

- a. Specific objectives of this program are to: (1) assist Tennessee State University continue to build on a collaborative network that will allow a strengthening of proposals to be submitted to for future funding, (2) develop/strengthen networks that will be used in disseminating findings from the research to be conducted in Tennessee, Mississippi, North Carolina, and other selected states by streamlining and strengthening the outreach activities to be covered in this project, (3) develop other dissemination plans and strategies such as community forums, state-wide radio messages, teleconferences and, web-based dissemination, and (4) explore, provide discussions, and input on the educational components (distance education, web training and instruction) of the proposal in ways that will capitalize on the capabilities of collaborating institutions.

During the period covered in this report, a planning and working meeting of the project collaborators was held to plan activities for the remainder of the 1-year research project, discuss objectives, finalize plans for convening the focus to be used in collecting the information for the project, finalize dates for all state meetings, develop documents for use in screening participants for the focus groups. Secondary research was used in putting together the guidelines developed for the moderators of the focus groups. Extension specialists are currently working with researchers from collaborating universities in identifying participants for the focus. Currently, collaborators from Arkansas, North Carolina, and Tennessee are putting together the focus groups needed to collect information on social acceptability of agricultural biotechnology. Subcontracts for all the Universities collaborating on the project have been approved.

- b. Discoveries/ Impacts:
- Grant funds made available to Tennessee State University has helped expand focus group research skill of participant in the project. The relationship between the 1890 and 1862 schools involved in the project has been strengthened through interactions by different researchers and faculty on the project. Extension's involvement with the project from the early stages of this project will ensure that relevant stakeholders have their share in the conduct and outcome of this research. Links between extension and research has been

strengthened because of this project. This strengthened linkage will allow the research team to develop a strong dissemination plan for the findings of the research project.

c. Source of Funding: USDA/CSREES

d. Scope of Impact: State-specific

Key Theme - Economic Opportunity Enhancement

a. Sub-contracts were prepared and sent to collaborators. Students have been hired to assist on the project. A survey instrument was developed to get feedback from extension agents on research, education, outreach and other needs of small farmers. A meeting of collaborators on the project was held at Tennessee State University (TSU) in November 2001 to discuss progress in implementing the plan of work developed for the project. At the meeting, a representative from the CSREES provided in Tennessee was summarized and discussed. It showed that the proposed research and outreach areas of production and management systems, marketing and information technology use was on target as tools for enhancing profitability of small farmers. The other collaborators are in the process of conducting a similar survey in their respective states. The collaborating institutions have been attending listening sessions, field days and/or focus group meetings with farmers will be to get feedback on research, education, and outreach as well as to discuss alternative enterprises in their respective areas. Each state is also in the process of forming a small farm advisory group consisting of representatives from government agencies such as the State Department of Agriculture, NASS, FSA, NRCS, non-government, and Community Based organizations. Such bodies are needed to provide the necessary local network in conducting research and outreach activities.

b. Discoveries/ Impacts:
Initiatives underway have provided opportunities for obtaining stakeholder input, discuss alternative enterprises, and set up local network to implement a regional research and outreach project that would enhance profitability of small farm operations. Another meeting of collaborators will be held to discuss outcomes of the effort underway and to incorporate them into the original proposal before resubmitting it for funding.

c. Source of Funding: USDA/CSREES

d. Scope of Impact: Multistate Integrated Research and Extension with AR and NC.

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 Cooperative Agricultural Research Program 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 5-Year Plan of Work.