

2010 Tennessee State University Research Plan of Work

Status: Accepted
Date Accepted: 06/08/09

I. Plan Overview

1. Brief Summary about Plan Of Work

The School of Agriculture and Consumer Sciences at Tennessee State University is grateful for the opportunity to collaborate with the United States Department of Agriculture, the State of Tennessee, various agricultural industries, and other public sector entities to improve the quality of life for citizens of our state and for people in other regions of the US. This Plan of Work represents our commitment to address the needs of our state specifically and the needs of our society in general. It is also a manifestation of our efforts to build strong, realistic, and mutually beneficial partnerships, to remain relevant to our stakeholders, and to pursue new frontiers in agricultural research.

In preparation for the development of this Plan of Work, a strategic planning process was conducted in 2005. The planning process involved every researcher and produced succinct research goals. This process is planned to be repeated in 2009.

The research objectives in this Plan of Work were created in cooperation with external stakeholders (private citizens and industry representatives) and internal stakeholders (faculty, researchers, students, staff, Cooperative Extension personnel, and administrators at Tennessee State University) using the goals developed in the strategic planning process. The School of Agriculture and Consumer Sciences is the principal agricultural and environmental research, outreach and academic entity at Tennessee State University.

The Planned Programs outlined in this Plan of Work reflect the coordinated efforts of our faculty to address the issues identified in the strategic planning process while linking them to issues of importance to Tennessee small farmers, underrepresented groups, and urban and rural families. Completion of the research outlined in this Plan of Work will make our food and environment safer, our families healthier, provide economic opportunities for our citizens, and provide experiential training opportunities for students at Tennessee State University.

In response to the suggestions presented by the reviewers of our 2008 Plan of Work submission, the Planned Programs in the current submission have been modified to better address broader research themes than in previous Plans of Work.

Estimated Number of Professional FTEs/SYs total in the State.

Year	Extension		Research	
	1862	1890	1862	1890
2010	0.0	0.0	0.0	55.0
2011	0.0	0.0	0.0	55.0
2012	0.0	0.0	0.0	55.0
2013	0.0	0.0	0.0	55.0
2014	0.0	0.0	0.0	55.0

II. Merit Review Process

1. The Merit Review Process that will be Employed during the 5-Year POW Cycle

- Internal University Panel
- External University Panel

2. Brief Explanation

Each Planned Program in this Plan of Work was approved by separate external and internal review panels. These panels were composed of agricultural research administrators in the 1890 University system. Potential Planned Programs were evaluated for relevance, scientific soundness, and appropriateness of planned outcomes. Only those proposed programs that were approved by both panels were developed into Planned Programs. A number of strategies were developed as a result of the strategic planning process outlined earlier to guarantee that approved programs are periodically reviewed to ensure they are meeting goals and remaining relevant: Prior to the initiation of research, researchers initiate contact with appropriate stakeholders, i.e., government agencies, community groups/representatives, professional organizations, extension personnel, or industry groups, to identify and prioritize critical needs. Periodically and upon completion of projects/programs, researchers initiate contact with appropriate stakeholders to evaluate the degree of program/project success. An administrator within the School of Agriculture and Consumer Sciences has been appointed to meet with every researcher at scheduled intervals to monitor the progress of the planned programs. If the program is not progressing as planned, appropriate remedial steps will be initiated. We feel that these procedures will contribute significantly to ensuring the Planned Programs will be executed completely and with maximum benefit to stakeholders.

III. Evaluation of Multis & Joint Activities

1. How will the planned programs address the critical issues of strategic importance, including those identified by the stakeholders?

The research programs in the TSU School of Agriculture and Consumer Sciences have an established record of soliciting, establishing, and maintaining direct input from stakeholders concerning research content and direction. The direct relationship we enjoy with our stakeholders and the feedback and oversight they provide to us ensures the research we perform addresses issues of strategic importance.

For example, our research programs relating to environmental concerns work closely with the Cumberland River Compact, a non-profit organization concerned with the health and well-being of the Cumberland Watershed, which encompasses much of Middle Tennessee. By working with this stakeholder organization our scientists have learned of the need to provide education for residents who own land adjacent to watershed tributaries: we learned that many of the landowners were unaware that some of their agricultural practices had far-reaching adverse effects on the watershed. As a result of this stakeholder interaction, new education initiatives have been implemented to target these landowners.

Also of interest in our environmental research was feedback from stakeholders that indicated that most were genuinely concerned about the proper environmental stewardship of the particular watershed being investigated. Prior to the feedback, it was generally assumed that stakeholders would place monetary concerns over environmental concerns. Knowledge of this information has helped in the design and dissemination of our findings and recommended practices.

Another example of stakeholder input affecting research is in our nursery pest management program; a portion of our research efforts emphasize finding the most effective and most economical treatments that would allow our stakeholders to comply with the mandates of federal fire ant quarantine policies. In discussions with stakeholders it was determined that economy was not always the main concern, and that different treatment options should be developed to facilitate integration of treatments into different business models. This finding has expanded the treatment options being investigated.

Clearly, not every example of our stakeholder input process can be detailed here; however, the relationship we maintain with our stakeholders has proven to be extremely valuable and will be continued.

Examples of other means our scientific programs use to identify critical issues include obtaining input through professional meetings, field days, research demonstrations, industry trade shows, consultations, and informal contacts. The involvement of extension colleagues (formally and informally) has further extended our outreach efforts to stakeholders. Input from all sources is discussed within the research teams and used to identify and assess research targets. Agricultural statistics published by the Tennessee Department of Agriculture, the National Agricultural Statistics Service, and the Tennessee Agricultural Statistics Service are also consulted to determine the economic importance of crops, pests, diseases, and other research issues.

2. How will the planned programs address the needs of under-served and under-represented populations of the State(s)?

As previously described, the planned programs in this Plan of Work are the culmination of a thorough strategic planning process that was used to define the scope and direction of the agriculture research programs at Tennessee State University. A component of the strategic planning process was the development of a mission statement to guide our research. A tenet of the mission statement is that our research generates scientific knowledge in the following areas: animal and alternative livestock; economics and policy; food safety, nutrition and family well-being; environmental protection and enhancement; and nursery, medicinal and alternative crops. Through this innovative research, we identify and address the needs of stakeholders, focus on finding solutions to challenges faced by socially and economically disadvantaged groups, and contribute to the prosperity of the

citizens of Tennessee and the nation.

Thus, each research goal, and subsequently each planned program, is based on a mandate to serve those members of our population that are traditionally classified as being underserved. In addition to focusing on socially and economically disadvantaged groups, our planned research programs also target groups not usually served by mainstream agriculture, *i.e.*, owners of small farms, producers of niche products, etc. Even though some of our planned programs may develop solutions to challenges faced by mainstream segments of our population, the core emphasis of the research will be on finding solutions that are acutely applicable to small producers, niche product producers, or persons who are economically or socially disadvantaged.

3. How will the planned programs describe the expected outcomes and impacts?

Outcomes and impacts for the Planned Programs are described within the program logic models for those Planned Programs. Each Planned Program includes defined outcome goals that will generate quantifiable impacts.

4. How will the planned programs result in improved program effectiveness and/or efficiency?

The objectives of the planned programs have been developed after a thorough strategic planning process in which the assets and liabilities of the agricultural research enterprise at TSU were examined. This examination included tangible items such as equipment, staffing, laboratory space, field space and greenhouse space, as well as intangible items such as the scientific and technical expertise of the university staff, and relationships with, and priorities of, stakeholders. Using the results of the strategic planning analysis, each scientist (and in some cases, scientist team) formulated research goals that best fit the strengths of the individual/team and the priorities of stakeholders. This procedure produced the best possible scenario for ensuring program effectiveness – building on known strengths in a synergistic research atmosphere, while addressing issues of concern to stakeholders. Because the planned programs were specifically developed with the end-user (stakeholder) in mind, the overall effectiveness of the planned programs should be very high.

This process has also led to planned programs that are utilizing space, equipment and expertise already in place in at Tennessee State University; only relatively small expenditures will be needed for new equipment. No unplanned additions of personnel are needed to complete the planned programs. Each individual researcher and research team now has defined output and outcome goals, providing a benchmark on which to measure progress. This scenario assures programmatic efficiency.

IV. Stakeholder Input

1. Actions taken to seek stakeholder input that encourages their participation

- Survey of traditional stakeholder individuals
- Targeted invitation to selected individuals from general public
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to traditional stakeholder groups
- Survey of traditional stakeholder groups

Brief explanation.

A number of different avenues are utilized by researchers in the School of Agriculture and Consumer Sciences to seek stakeholder input. Most of the faculty in the School are active participants in the trade associations related to their research (*i.e.* Tennessee Goat Producers Association, Tennessee Nursery and Landscapers Association), and regularly serve on association committees, attend association trade shows, have research exhibits at association trade shows, and act as speakers at educational functions sponsored by the associations. This relationship permits a marked level of both formal and informal interaction with stakeholders. Another method of garnering stakeholder input is through formal meetings with distinct groups of stakeholders established specifically to provide input for a given area of research. An example of this sort of group is our Nursery Advisory Group, a group of established nursery producers from throughout the state that meets to review the nursery related research activities of the Institute, and whose members are regularly utilized for industry information. Our scientists also serve on public advisory boards related to their areas of research; this service enables them to develop relationships with, and receive information from, a wide range of stakeholders.

2(A). A brief statement of the process that will be used by the recipient institution to identify individuals and groups stakeholders and to collect input from them

1. Method to identify individuals and groups

- Use Surveys
- Use Internal Focus Groups
- Needs Assessments
- Other (See explanation below.)
- Use Advisory Committees

Brief explanation.

For the 'Other' category, a number of different methods were used: 1) meetings with regulatory officials; 2) discussions with other researchers performing research in the area; 3) meetings with trade group representatives; and 4) discussions with related stakeholder groups.

2(B). A brief statement of the process that will be used by the recipient institution to identify individuals and groups who are stakeholders and to collect input from them

1. Methods for collecting Stakeholder Input

- Survey specifically with non-traditional individuals
- Meeting specifically with non-traditional individuals
- Survey of traditional Stakeholder groups
- Survey of traditional Stakeholder individuals
- Meeting with traditional Stakeholder individuals
- Meeting with traditional Stakeholder groups

Brief explanation

Most stakeholder input is collected in either face-to-face discussions or via survey instruments. Each of these methods are effective. The face-to-face discussions are often held in a group setting, this allow for questions answers to direct and stimulate discussion of areas of importance to stakeholders. However, individual discussions are also an important source of input. We have found that some persons are not comfortable speaking out in a group, but are very willing to email opinions and ideas, or to speak one-on-one with scientists. Survey instruments are a useful tool to assess information from broader groups of stakeholders. While some stakeholders prefer the anonymity and brevity of a survey instrument (resulting in increased participation), the survey instrument does not allow for discussion of previously unrecognized areas of concern.

3. A statement of how the input will be considered

- To Identify Emerging Issues
- Redirect Research Programs
- To Set Priorities

Brief explanation.

The close involvement of Tennessee State University scientists with stakeholder groups and individuals provides an almost constant feedback on the utility and practicality of the research we conduct and the solutions we pursue. We engage our stakeholders in discussion of all aspects of our research, from planning, to execution, to dissemination of results. Examples of our use of feedback are presented in section III 1 of this report:

For example, our research programs relating to watershed concerns work closely with the Cumberland River Compact, a non-profit organization concerned with the health and well-being of the Cumberland Watershed, which encompasses much of Middle Tennessee. By working with this stakeholder organization our scientists have learned of the need to provide education for residents who own land adjacent to watershed tributaries. As a result of our interactions with this stakeholder group we learned that many of the landowners were unaware that some of their agricultural practices had far-reaching adverse effects on the watershed. As a result of this stakeholder interaction, new education initiatives have been implemented to target these landowners.

Also of interest in our environmental research was feedback from stakeholders that indicated that most were genuinely concerned about the proper environmental stewardship of the particular watershed being investigated. Prior to the feedback, it was generally assumed that stakeholders would place monetary concerns over environmental concerns. Knowledge of this

information has helped in the design and dissemination of our findings and recommended practices.

Another example of stakeholder input affecting research is in our nursery pest management program; a portion of our research efforts emphasize finding the most effective and most economical treatments that would allow our stakeholders to comply with the mandates of federal fire ant quarantine policies. In discussions with stakeholders it was determined that economy was not always the main concern, and that different treatment options should be developed to facilitate integration of treatments into different business models. This finding has expanded the treatment options being investigated.

V. Planned Program Table of Content

S. NO.	PROGRAM NAME
1	Enhancing prosperity of small farms.
2	Molecular approaches for the study of microorganisms in plants.
3	Improving families through better nutrition and enhanced well-being.
4	Strategies to monitor and mitigate environmental impacts of agriculture.
5	Improving agricultural plants through reduced response to stress.
6	Research to mitigate food-borne illness.
7	Reducing plant pest problems in the green industry using environmentally sound methods.

V(A). Planned Program (Summary)**Program #1****1. Name of the Planned Program**

Enhancing prosperity of small farms.

2. Brief summary about Planned Program

The overall objective of this program is to increase the prosperity of small farms by providing new options in plant and animal production and improving business practices.

This planned program will evaluate accessions of goldenseal (*Hydrastis canadensis*) and a number of heirloom varieties of pepper and tomato for their suitability as income-producing niche crops for small and limited-resource farm owners. Field evaluations will be conducted to determine the varieties and cultural methods most suitable for production in Tennessee.

This program will also address the development and enhancement of alternative agriculture enterprises for small farmers in Tennessee, particularly as an alternative to beef cattle production, tobacco farming, and other farming activities for which small farmers are losing markets, or are likely to lose market share. The program emphasizes the development and introduction of competitive meat goat and guinea fowl production systems. The meat goat industry is an immature, expanding industry in Tennessee and across the southeastern US. Presently, industry growth is based on doe reproductive output and requires mature does to sustain their productivity for years to meet consumer demand for chevon or cabrito and to generate replacement doelings to continue herd expansion. This project assesses the ability of does, representing distinct breeds, to stay in the herd and be productive over many years under semi-intensive, pasture management conditions that are typical of commercial production systems of the Southeast.

Adoption and profitability of the guinea fowl as alternative poultry for small scale and limited resource farmers in Tennessee will be enhanced through research in the requirement for floor space and selected macro-minerals (calcium and phosphorus) and essential amino acids (methionine and lysine) for optimum performance of the guinea fowl.

Research conducted in this program will also introduce classical and contemporary animal breeding tools (marker-assisted selection) to improve production and reproductive efficiency of meat goat and guinea fowl. Major genes that affect economically important traits such as carcass quality and disease resistance will be identified.

This planned program will additionally focus on increasing awareness, improving record keeping, and increased knowledge in the management and adoption of alternative crops to enable small farm owners to operate economically viable enterprises based on analysis of farm enterprise budgets and assessment of alternative market channels. The program will (1) use secondary data to develop profiles of the green industry and related sub-sectors, (2) provide information for participation in the industry using printed materials and websites, (3) collect primary data using mail surveys and focus groups to identify opportunities and challenges in the industry, (4) develop strategies to assist existing producers and assist the entry of new small producers into the industry and related sub-sectors, and (5) analyze consumer behavior towards products and service provided by the green industry and related sub-sectors.

3. Program existence : Intermediate (One to five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
202	Plant Genetic Resources and Biodiversity				25%
205	Plant Management Systems				8%
301	Reproductive Performance of Animals				8%
302	Nutrient Utilization in Animals				8%
303	Genetic Improvement of Animals				5%
304	Animal Genome				4%
307	Animal Production Management Systems				8%
601	Economics of Agricultural Production and Farm Management				9%
604	Marketing and Distribution Practices				22%
610	Domestic Policy Analysis				3%
	Total				100%

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Many small and minority-owned farms are in need of alternative avenues of revenue to remain viable. Niche crops have potential to provide addition income. Interest in heirloom varieties of vegetables for human consumption and as ornamentals is increasing; identification of heirloom forms suitable for Tennessee production will increase their production for niche markets in Tennessee. Science-based agricultural production systems for medicinal crops offer logical solutions to these problems while at the same time presenting opportunities for small farmers to enhance efficiency and profitability by producing them as a crop. Development of efficient methods of plantation establishment and identification of high alkaloid yielding cultivars are areas that will benefit from additional research.

Guinea fowl can serve as alternative poultry crop for small scale and limited resource farmers. Feeding cost is a major constraint to guinea fowl production. Optimization of parameters such as the requirement for macro-minerals such as calcium and phosphorus and essential amino acids such as methionine and lysine are needed. Rapid growth rate of meat-type chickens and guinea fowl has compromised carcass quality due to excessive fat deposition. Birds that attain market weight at an early age and yet deposit less carcass fat will be highly desirable. Major genes that control growth and adipose accumulation will be

identified by analyzing growth and adipose specific transcriptome in chicken, then testing the influence of these genes on growth and fat content in both chicken and guinea fowl reference populations.

New entrants to the meat goat industry often experience problems with does due to poor genetic /environmental combinations. Many of the problems stem from environmental constraints. Biologically, sick does will have poor reproductive output and will likely die or be culled. Increased management inputs and early doe exits from the herd are each costly to the producer, as is the acquisition of replacements that potentially may also suffer from poor fitness and reproductive output. It would be of benefit to producers to maintain a viable herd of mature does that do not require an intensive, resource demanding management scheme. This can be achieved by a better understanding of genetic influences on doe fitness, productivity, and longevity.

The green industry is experiencing rapid growth but is dominated by large producers. There are entry barriers, both perceived and real, for small producers. Tennessee small farmers, who historically have derived significant portions of their income from growing tobacco, are presently especially economically vulnerable under the tobacco buyout program. One reason for this vulnerability is their operations are not as diversified as those of large agricultural producers. A key question is: what strategies and programs should be pursued to ensure that small farmers will remain economically viable under this circumstance? Economic viability of such farmers will be realized when the farmers are equipped with research-based economic tools that they can apply to their operations.

2. Scope of the Program

- In-State Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

Small farm operations need high value products to remain viable. Heirloom plant varieties, medicinal crops, alternative poultry and meat animal production are viable small farm enterprises.

Consumer interest in value-added crops will continue. Heirloom vegetables and Goldenseal are potentially high value crops that can be profitably produced on small scale, limited resource farms. Varieties and selections of these crops that are tolerant to disease, insect and drought stress can be identified. Goldenseal clones with high alkaloid and ornamental characteristics can be identified and multiplied.

Alternative poultry is a potentially profitable option for small farmers. Improved feeding programs for the guinea fowl will minimize feeding cost and enhance success of a guinea fowl production enterprise. Experimental birds will be readily available when needed to initiate studies. In addition, enhanced animal performance through improved management techniques and genetic stock will result in greater economic returns.

Genetic fitness and longevity is of increased importance for the meat goat industry because FDA-approved pharmaceuticals for goats are very few in number. Meat goat fitness and longevity is of major concern in Tennessee and across the Southeast because without significant management inputs, environmental conditions in the region create major obstacles to maintaining adequate goat health.

In the analysis of small farm operations, a reasonable degree of cooperation is expected from producers and consumers. The personnel in the program have the necessary skills to conduct the proposed work. It is assumed that the results of the program will benefit both producers and consumers. Results of this program will enhance the knowledge of small farmers and lead to economically viable farm operations. It is assumed that farmers and extension agents will be supportive of this project both in the data collection phase and in delivery of results. Farmers are also expected to indicate what other (non-tobacco) enterprises they want to operate—if they are staying in farming, or what they plan to do if they exit from farming. Staff and facilities for the proposed research are available at Tennessee State University.

2. Ultimate goal(s) of this Program

Develop adapted, high-value alternative enterprises and production practices as profitable options for small and limited – resource farmers. To evaluate medicinal and heirloom crops through field evaluations and demonstrations, and to address related areas of plant breeding and human health.

Enhance the adoption of meat goat and guinea fowl as alternative livestock for small scale farmers and to ensure sustainability and profitability of the enterprise through improved animal breeding, management and feeding programs.

Generate research-based results that will enhance the economic well-being of producers and consumers of green industry products and to improve the post-tobacco buyout economic well being of small farmers through selection of economically viable alternative enterprises and outreach.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2010	0.0	0.0	0.0	19.7
2011	0.0	0.0	0.0	19.7
2012	0.0	0.0	0.0	19.7
2013	0.0	0.0	0.0	19.7
2014	0.0	0.0	0.0	19.7

V(F). Planned Program (Activity)

1. Activity for the Program

Conduct field, greenhouse and laboratory research experiments on heirloom and medicinal crops; install and evaluate field demonstration plots. Germplasm evaluation, DNA analysis, cultivation method development.

Generate a cDNA library for the guinea fowl. Develop chicken, guinea fowl and meat goat genetic resource populations. Use microArray to identify adipose specific transcriptome. Evaluate concentrate supplementation options for meat goat performance.

Determine optimum floor space allowance for guinea fowl. Determine optimum requirement for dietary calcium and phosphorus by guinea fowl and determine optimum dietary requirement for methionine and lysine by guinea fowl.

Conduct genetic and environmental research to enhance meat goat longitudinal doe performance, conduct producer workshops on assessing does for fitness and reproductive output.

Hold focus group meetings to develop a comprehensive survey instrument for collecting data on the current situation and future prospects on various issues in small farm operations. Develop enterprise budget forms to collect data necessary to conduct economic analysis. Make results derived from analyses available to farmers to assist them to be economically viable.

Develop brochures, fact sheets and other publications containing project results and distribute to stakeholders. Provide information to green industry and related sub-sector service providers at special events such as trade shows and field days.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> ● Demonstrations 	<ul style="list-style-type: none"> ● Web sites

3. Description of targeted audience

Small farmers, agricultural research community, crop producers, plant breeders, retailers of vegetable and ornamental plant seeds, Extension agents, policy makers, homeowners, medicinal plant industry, landscape businesses, consumers of green industry products and services, meat goat industry, Guinea fowl and poultry industries.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0

2. (Standard Research Target) Number of Patent Applications Submitted

Expected Patent Applications

2010 :0 2011 :0 2012 :0 2013 :0 2014 :0

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2010	7	0	7
2011	7	0	7
2012	7	0	7
2013	7	0	7
2014	7	0	7

V(H). State Defined Outputs

1. Output Target

- Development of new Goldenseal cultivars.

2010 :0 2011 :0 2012 :2 2013 :0 2014 :0

- Development of microproagation techniques for high berberine/hydrastine yielding cultivars of Goldenseal.

2010 :0 2011 :0 2012 :1 2013 :0 2014 :0

- Establishment of demonstration areas for improved cultural practices of Goldenseal.

2010 :0 2011 :0 2012 :1 2013 :0 2014 :0

- Cost analysis for Goldenseal production.

2010 :0 2011 :0 2012 :0 2013 :1 2014 :0

- Evaluation of livestock management techniques for economic feasibility.

2010 :1 2011 :1 2012 :1 2013 :1 2014 :1

- Development of chicken, Guinea fowl and meat goat genetic resource populations.

2010 :1 2011 :1 2012 :0 2013 :0 2014 :0

- Construction of cDNA library for Guinea fowl.

2010 :1	2011 :1	2012 :0	2013 :0	2014 :0
----------------	----------------	----------------	----------------	----------------

- Dietary recommendations to guinea fowl producers for optimal production.

2010 :1	2011 :1	2012 :1	2013 :0	2014 :0
----------------	----------------	----------------	----------------	----------------

- Technique to determine optimal nutrient composition of guinea fowl diet.

2010 :0	2011 :1	2012 :1	2013 :0	2014 :0
----------------	----------------	----------------	----------------	----------------

- Number of techniques to improve productivity and longevity of meat goat does.

2010 :1	2011 :1	2012 :0	2013 :0	2014 :0
----------------	----------------	----------------	----------------	----------------

- Number of meat goat producers participating in doe record keeping.

2010 :30	2011 :40	2012 :50	2013 :50	2014 :50
-----------------	-----------------	-----------------	-----------------	-----------------

- Average increase per herd of reproduction-based doe retention rate.

2010 :1	2011 :1	2012 :2	2013 :0	2014 :0
----------------	----------------	----------------	----------------	----------------

- Policy papers relating to the economic viability of small farmers.

2010 :1	2011 :1	2012 :2	2013 :1	2014 :1
----------------	----------------	----------------	----------------	----------------

V(I). State Defined Outcome

O. No	Outcome Name
1	Number of additional producers with increased knowledge of varieties, attributes and growing practices of heirloom varieties.
2	Additional number of consumers with increased knowledge of attributes of heirloom varieties.
3	Additional number of students gaining knowledge of heirloom variety characteristics.
4	Number of DNA profiles developed to facilitate marker-assisted breeding.
5	Number of graduate students trained in DNA based plant characterization techniques.
6	Number of protocols for DNA characterization to establish true-to-type identification of varieties.
7	Number of significant functional elements (such as amino acids and vitamins) characterized in heirloom varieties.
8	Number of improved Goldenseal cultivars released.
9	Number of techniques defined for improved Goldenseal production.
10	Increase in number of producers with an increase in exports of nursery products and producers' income.
11	Increase in number of producers with increased sales and income.
12	Increase in number of producers receiving assistance in decreasing knowledge gaps, marketing and market access.
13	Increase in number of producers with increased knowledge of exports potential and opportunities by producers.
14	Increase in number of producers with increased awareness of alternative crops.
15	Increase in number of producers adopting alternative crop production.
16	Increase in number of producers with increased farm diversification.
17	Number of adipose-specific genes identified in alternative poultry species.
18	Number of alternative poultry birds examined in genetic resource population.
19	Number of meat goats screened for genetic markers.
20	Percentage of Guinea fowl producers realizing savings in feeding costs.
21	Percentage of producers implementing recommendations for optimized Guinea fowl production.
22	Percentage of Guinea fowl producers realizing profitability after adoption of recommendations.

Outcome #1**1. Outcome Target**

Number of additional producers with increased knowledge of varieties, attributes and growing practices of heirloom varieties.

2. Outcome Type : Change in Knowledge Outcome Measure

2010 :20 2011 : 20 2012 : 20 2013 : 30 2014 : 0

3. Associated Institute Type(s)

•1890 Research

4. Associated Knowledge Area(s)

- 202 - Plant Genetic Resources and Biodiversity
- 205 - Plant Management Systems

Outcome #2**1. Outcome Target**

Additional number of consumers with increased knowledge of attributes of heirloom varieties.

2. Outcome Type : Change in Knowledge Outcome Measure

2010 :25 2011 : 25 2012 : 35 2013 : 50 2014 : 75

3. Associated Institute Type(s)

•1890 Research

4. Associated Knowledge Area(s)

- 202 - Plant Genetic Resources and Biodiversity
- 205 - Plant Management Systems

Outcome #3**1. Outcome Target**

Additional number of students gaining knowledge of heirloom variety characteristics.

2. Outcome Type : Change in Knowledge Outcome Measure

2010 :10 2011 : 10 2012 : 10 2013 : 10 2014 : 10

3. Associated Institute Type(s)

•1890 Research

4. Associated Knowledge Area(s)

- 202 - Plant Genetic Resources and Biodiversity
- 205 - Plant Management Systems

Outcome #4**1. Outcome Target**

Number of DNA profiles developed to facilitate marker-assisted breeding.

2. Outcome Type : Change in Knowledge Outcome Measure

2010 :1 2011 : 1 2012 : 0 2013 : 0 2014 : 0

3. Associated Institute Type(s)

•1890 Research

4. Associated Knowledge Area(s)

- 202 - Plant Genetic Resources and Biodiversity

Outcome #5

1. Outcome Target

Number of graduate students trained in DNA based plant characterization techniques.

2. Outcome Type : Change in Knowledge Outcome Measure

2010 :1 2011 : 1 2012 : 1 2013 :1 2014 :1

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 202 - Plant Genetic Resources and Biodiversity

Outcome #6

1. Outcome Target

Number of protocols for DNA characterization to establish true-to-type identification of varieties.

2. Outcome Type : Change in Knowledge Outcome Measure

2010 :1 2011 : 0 2012 : 0 2013 : 0 2014 :0

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 202 - Plant Genetic Resources and Biodiversity

Outcome #7

1. Outcome Target

Number of significant functional elements (such as amino acids and vitamins) characterized in heirloom varieties.

2. Outcome Type : Change in Knowledge Outcome Measure

2010 :1 2011 : 2 2012 : 2 2013 : 2 2014 :2

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 202 - Plant Genetic Resources and Biodiversity

Outcome #8

1. Outcome Target

Number of improved Goldenseal cultivars released.

2. Outcome Type : Change in Action Outcome Measure

2010 :0 2011 : 0 2012 : 2 2013 : 0 2014 :0

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 202 - Plant Genetic Resources and Biodiversity

Outcome #9

1. Outcome Target

Number of techniques defined for improved Goldenseal production.

2. Outcome Type : Change in Action Outcome Measure

2010 0 2011 : 2 2012 : 2 2013 0 2014 : 0

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 202 - Plant Genetic Resources and Biodiversity

Outcome #10

1. Outcome Target

Increase in number of producers with an increase in exports of nursery products and producers' income.

2. Outcome Type : Change in Action Outcome Measure

2010 20 2011 : 20 2012 : 20 2013 20 2014 : 20

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 601 - Economics of Agricultural Production and Farm Management
- 610 - Domestic Policy Analysis

Outcome #11

1. Outcome Target

Increase in number of producers with increased sales and income.

2. Outcome Type : Change in Action Outcome Measure

2010 65 2011 : 65 2012 : 65 2013 65 2014 : 65

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 604 - Marketing and Distribution Practices

Outcome #12

1. Outcome Target

Increase in number of producers receiving assistance in decreasing knowledge gaps, marketing and market access.

2. Outcome Type : Change in Action Outcome Measure

2010 :75 2011 : 75 2012 : 75 2013 75 2014 : 75

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 601 - Economics of Agricultural Production and Farm Management
- 604 - Marketing and Distribution Practices

Outcome #13

1. Outcome Target

Increase in number of producers with increased knowledge of exports potential and opportunities by producers.

2. Outcome Type : Change in Action Outcome Measure

2010 :50 **2011** : 50 **2012** : 50 **2013** :50 **2014** :50

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 601 - Economics of Agricultural Production and Farm Management
- 604 - Marketing and Distribution Practices

Outcome #14

1. Outcome Target

Increase in number of producers with increased awareness of alternative crops.

2. Outcome Type : Change in Action Outcome Measure

2010 :100 **2011** : 100 **2012** : 100 **2013** :100 **2014** :100

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 604 - Marketing and Distribution Practices

Outcome #15

1. Outcome Target

Increase in number of producers adopting alternative crop production.

2. Outcome Type : Change in Action Outcome Measure

2010 :15 **2011** : 15 **2012** : 15 **2013** :15 **2014** :15

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 604 - Marketing and Distribution Practices

Outcome #16

1. Outcome Target

Increase in number of producers with increased farm diversification.

2. Outcome Type : Change in Action Outcome Measure

2010 :15 **2011** : 15 **2012** : 15 **2013** :15 **2014** :15

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 604 - Marketing and Distribution Practices

Outcome #17

1. Outcome Target

Number of adipose-specific genes identified in alternative poultry species.

2. Outcome Type : Change in Knowledge Outcome Measure

2010 25 **2011** : 25 **2012** : 10 **2013** 5 **2014** :1

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 302 - Nutrient Utilization in Animals
- 303 - Genetic Improvement of Animals

Outcome #18

1. Outcome Target

Number of alternative poultry birds examined in genetic resource population.

2. Outcome Type : Change in Knowledge Outcome Measure

2010 200 **2011** : 200 **2012** : 200 **2013** 200 **2014** :200

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 304 - Animal Genome

Outcome #19

1. Outcome Target

Number of meat goats screened for genetic markers.

2. Outcome Type : Change in Knowledge Outcome Measure

2010 40 **2011** : 60 **2012** : 40 **2013** 40 **2014** :40

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 303 - Genetic Improvement of Animals
- 304 - Animal Genome

Outcome #20

1. Outcome Target

Percentage of Guinea fowl producers realizing savings in feeding costs.

2. Outcome Type : Change in Condition Outcome Measure

2010 50 **2011** : 90 **2012** : 90 **2013** 95 **2014** :95

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 307 - Animal Production Management Systems

Outcome #21

1. Outcome Target

Percentage of producers implementing recommendations for optimized Guinea fowl production.

2. Outcome Type : Change in Condition Outcome Measure

2010 90 **2011** : 95 **2012** : 95 **2013** 95 **2014** :95

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 302 - Nutrient Utilization in Animals
- 307 - Animal Production Management Systems

Outcome #22

1. Outcome Target

Percentage of Guinea fowl producers realizing profitability after adoption of recommendations.

2. Outcome Type : Change in Condition Outcome Measure

2010 80 **2011** : 90 **2012** : 90 **2013** 95 **2014** :95

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 302 - Nutrient Utilization in Animals
- 307 - Animal Production Management Systems

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Natural Disasters (drought,weather extremes,etc.)
- Appropriations changes
- Competing Programmatic Challenges
- Populations changes (immigration,new cultural groupings,etc.)

Description

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- {NO DATA ENTERED}

Description

2. Data Collection Methods

- {NO DATA ENTERED}

Description

V(A). Planned Program (Summary)**Program #2****1. Name of the Planned Program**

Molecular approaches for the study of microorganisms in plants.

2. Brief summary about Planned Program

Plant pathogenic pseudomonads, typified by *Pseudomonas syringae* pathovars are a very diverse group of bacteria with respect to their genetics, ecology, and the types of diseases they cause. *Pseudomonas syringae*, which is normally an epiphyte, but can change into a pathogen, has approximately 50 pathovars attacking different hosts in all climatic zones and is arguably the most important plant pathogenic bacterium. This bacterium inhabits the leaf surface simultaneously with a yet uncharacterized diverse population of other microbes. In this planned program, a pathosystem between *Pseudomonas syringae* and ornamental host plants will be established and the microbial diversity of the leaf surface will be characterized. Interactions, such as cell-cell communication between *Pseudomonas* and these other bacteria, will be studied and with the goal of identifying the trigger mechanism for the switch from epiphyte to pathogen.

3. Program existence : Intermediate (One to five years)

4. Program duration : Medium Term (One to five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
212	Pathogens and Nematodes Affecting Plants				100%
	Total				100%

V(C). Planned Program (Situation and Scope)**1. Situation and priorities**

Plant diseases harm the US and the world in many ways; the most obvious and most quantifiable of which is the dollars lost in agriculture, landscape, and forestry through low yields, poor product quality or shelf-life, and decreasing aesthetic or nutritional value. Other, less tangible, costs such as environmental degradation due to heavy use of pesticides and pollution of water resources also exist. Plant disease results from the interaction of three factors: a susceptible host plant, a disease-causing organism, and environmental conditions favorable for pathogen growth. The main tactic of plant disease control/management strategies is to disrupt the disease cycle and break the continuity of the disease. A good plant disease control strategy therefore requires an intimate knowledge of the interactions among these three factors, as well as other external factors influencing these interactions. This planned program seeks to gain an understanding at the mechanistic level of the interactions necessary to initiate the infection process between the important bacterial pathogen *Pseudomonas syringae* and the niche and ornamental crops of importance to Tennessee.

2. Scope of the Program

- In-State Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

Pseudomonas syringae survives as an epiphyte on leaf surfaces, including surfaces of susceptible plants. When induced by a yet unknown signal, the harmless bacterium switches from the epiphytic mode to a pathogenic mode. The plant leaf surface is also inhabited by a wide diversity of microorganisms which cohabitate with *Pseudomonas syringae*. Additionally, many strains of *Pseudomonas syringae* produce the widely prevalent bacterial cell-to-cell (quorum-sensing) signal molecules known as autoinducers (AI). Bacterial cell-to-cell communication is influenced by the concentration of these molecules in the environment. Some *Pseudomonas* strains produce AI but do not respond to it, suggesting that there is some interaction between *Pseudomonas* and other members of the leaf surface community, either in the peaceful coexistence process or the epiphyte-pathogen switch of *Pseudomonas*. Therefore, an understanding of the microbial diversity of the leaf surface and the interaction between these microbes and *Pseudomonas* could reveal the nature of this interaction and offer an opportunity to use this knowledge to block the epiphyte-pathogen switch possibly by using one of the newly characterized leaf surface neighbors of *Pseudomonas*.

2. Ultimate goal(s) of this Program

An increased understanding of the diversity of leaf surface microbes and their interactions with each other and the ornamental host plant, leading to new disease control techniques.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2010	0.0	0.0	0.0	2.5
2011	0.0	0.0	0.0	2.5
2012	0.0	0.0	0.0	2.5
2013	0.0	0.0	0.0	2.5
2014	0.0	0.0	0.0	2.5

V(F). Planned Program (Activity)

1. Activity for the Program

Development of a pathosystem between *Pseudomonas* and ornamental/nursery crops. Optimize the parameters important for the pathogenicity process. Characterize the diversity and community structure of leaf surface microorganisms in the natural environments under diseased and healthy conditions. Characterize the interactions between epiphytic populations of *Pseudomonas*. Generate a list of microbial organisms which cohabitate the phyllosphere with the *Pseudomonas* bacteria. Assess the possible use of any of these epiphytic organism as a biocontrol agent to be armed with anti-pathogen activities. Provide experiential learning to TSU students on agricultural biotechnology.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> Other 1 (None, not an Extension program) 	<ul style="list-style-type: none"> Other 1 (None, not an Extension program)

3. Description of targeted audience

The immediate primary audience is the agricultural research community interested in understanding plant disease at the molecular level and using this understanding to design alternative disease management strategies. Regulatory agencies will also use the knowledge generated for policy formulation and growers will benefit from improved disease management strategies developed.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0

2. (Standard Research Target) Number of Patent Applications Submitted

Expected Patent Applications

2010 :0 2011 :0 2012 :0 2013 :0 2014 :0

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2010	1	0	1
2011	1	0	1
2012	1	0	1
2013	0	0	0
2014	0	0	0

V(H). State Defined Outputs

1. Output Target

- Scientific publications relating to plant/leaf microbe interactions

2010 :1 2011 :1 2012 :1 2013 :0 2014 :0

- Number of techniques to evaluate host/leaf surface microbe interactions

2010 :0 2011 :1 2012 :1 2013 :0 2014 :0

- Number of pertinent bacterial strains identified

2010 :0 2011 :2 2012 :2 2013 :0 2014 :0

V(I). State Defined Outcome

O. No	Outcome Name
1	Number of potential biocontrol candidates identified
2	Number of crops with blocked epiphyte-pathogen switch identified

Outcome #1

1. Outcome Target

Number of potential biocontrol candidates identified

2. Outcome Type : Change in Knowledge Outcome Measure

2010 0	2011 : 1	2012 : 1	2013 0	2014 :0
--------	----------	----------	--------	---------

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 212 - Pathogens and Nematodes Affecting Plants

Outcome #2

1. Outcome Target

Number of crops with blocked epiphyte-pathogen switch identified

2. Outcome Type : Change in Condition Outcome Measure

2010 :1	2011 : 1	2012 : 1	2013 0	2014 :0
---------	----------	----------	--------	---------

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 212 - Pathogens and Nematodes Affecting Plants

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Natural Disasters (drought,weather extremes,etc.)
- Public Policy changes
- Appropriations changes
- Government Regulations

Description

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- During (during program)
- Time series (multiple points before and after program)

Description

2. Data Collection Methods

- Observation
- Sampling

Description

V(A). Planned Program (Summary)

Program #3

1. Name of the Planned Program

Improving families through better nutrition and enhanced well-being.

2. Brief summary about Planned Program

This planned program will focus on the development of programs for children that teach nutrition and health, and will employ innovative strategies for sharing this knowledge with parents/grandparents and other relatives. Emphasis will be placed on techniques for implementing the 2005 Dietary Guidelines when on a limited budget. Additionally, techniques will be used to stimulate the participation of adult males in the project, a group that is often lacking in educational programs. This multigenerational, intergenerational transmission of beneficial health and nutrition behaviors should lead to enhanced quality of family well-being.

3. Program existence : Intermediate (One to five years)

4. Program duration : Medium Term (One to five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
703	Nutrition Education and Behavior				25%
704	Nutrition and Hunger in the Population				25%
724	Healthy Lifestyle				25%
801	Individual and Family Resource Management				25%
	Total				100%

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Children who are in poor health have a more difficult time in school, both socially and academically, a situation which is exacerbated by high absenteeism. The Food Safety, Nutrition and Family Well-being Team places a high priority on the development of healthy practices that focus on solutions to challenges faced by socially and economically disadvantaged groups. Family well-being is promoted when children engage their parents/caregivers/relatives in health-promoting activities.

2. Scope of the Program

- In-State Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

Increased knowledge of healthy behaviors will lead to an increase in healthier behaviors. Analysis of a combination of reported and actual behaviors will lead to a more complete understanding of the link between knowledge and behavior. It is assumed that permission will be given by parents for their children to participate in this planned program. It is further assumed that the children will be able to engage their relatives in the activities.

2. Ultimate goal(s) of this Program

To improve nutrition and health-related behaviors of limited resource households through innovative, family centered educational programs.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2010	0.0	0.0	0.0	3.4
2011	0.0	0.0	0.0	3.4
2012	0.0	0.0	0.0	3.4
2013	0.0	0.0	0.0	3.4
2014	0.0	0.0	0.0	3.4

V(F). Planned Program (Activity)

1. Activity for the Program

A program will be developed and activities will be designed to educate adults and children in a long-term healthy living lifestyle. Participants will be pre-and post-tested on behavioral changes after participation in the program. The participants will exhibit improved parameters such as healthier weight, lower blood pressure, more desirable percent body fat, better school attendance, and improved family well-being. Targeted stakeholder agencies will benefit from increased parental participation in their programs.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> Other 1 (None, not an Extension program) 	<ul style="list-style-type: none"> Other 1 (None, not an Extension program)

3. Description of targeted audience

Limited resource families in Nashville with children ages 3-8.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0

2. (Standard Research Target) Number of Patent Applications Submitted

Expected Patent Applications

2010 :0 2011 :0 2012 :0 2013 :0 2014 :0

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2010	1	0	0
2011	1	0	0
2012	1	0	0
2013	0	0	0
2014	0	0	0

V(H). State Defined Outputs

1. Output Target

- Scientific publications concerning the challenges of limited resource households in meeting dietary guidelines and food purchasing practices of economically disadvantaged families.

2010 :1 2011 :1 2012 :1 2013 :0 2014 :0

- Development of complete set of games for project use

2010 :0 2011 :0 2012 :0 2013 :0 2014 :0

- Development of healthy mini-camp curricula

2010 :1 2011 :0 2012 :0 2013 :0 2014 :0

- Development of complete set of online lessons for parents

2010 :1 2011 :0 2012 :0 2013 :0 2014 :0

- Development of newsletters for families.

2010 0

2011 0

2012 :0

2013 0

2014 0

V(I). State Defined Outcome

O. No	Outcome Name
1	Percentage of participants with increased nutrition knowledge
2	Percentage of participants with improved reported behaviors
3	Quarterly percent increase in participation points
4	Annual percent increase in number of males participating
5	Percentage decrease in school absenteeism

Outcome #1**1. Outcome Target**

Percentage of participants with increased nutrition knowledge

2. Outcome Type : Change in Knowledge Outcome Measure

2010 :25	2011 :25	2012 :30	2013 0	2014 :0
-----------------	-----------------	-----------------	---------------	----------------

3. Associated Institute Type(s)

•1890 Research

4. Associated Knowledge Area(s)

- 703 - Nutrition Education and Behavior
- 724 - Healthy Lifestyle

Outcome #2**1. Outcome Target**

Percentage of participants with improved reported behaviors

2. Outcome Type : Change in Action Outcome Measure

2010 :12	2011 :12	2012 :15	2013 0	2014 :0
-----------------	-----------------	-----------------	---------------	----------------

3. Associated Institute Type(s)

•1890 Research

4. Associated Knowledge Area(s)

- 703 - Nutrition Education and Behavior
- 724 - Healthy Lifestyle

Outcome #3**1. Outcome Target**

Quarterly percent increase in participation points

2. Outcome Type : Change in Action Outcome Measure

2010 3	2011 :5	2012 :5	2013 0	2014 :0
---------------	----------------	----------------	---------------	----------------

3. Associated Institute Type(s)

•1890 Research

4. Associated Knowledge Area(s)

- 703 - Nutrition Education and Behavior
- 724 - Healthy Lifestyle

Outcome #4**1. Outcome Target**

Annual percent increase in number of males participating

2. Outcome Type : Change in Action Outcome Measure

2010 :10	2011 :10	2012 :10	2013 0	2014 :0
-----------------	-----------------	-----------------	---------------	----------------

3. Associated Institute Type(s)

•1890 Research

4. Associated Knowledge Area(s)

- 703 - Nutrition Education and Behavior
- 724 - Healthy Lifestyle

Outcome #5

1. Outcome Target

Percentage decrease in school absenteeism

2. Outcome Type : Change in Condition Outcome Measure

2010 :10 2011 : 20 2012 : 20 2013 0 2014 :0

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 703 - Nutrition Education and Behavior
- 724 - Healthy Lifestyle

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Other (Competition for time of partic.)
- Natural Disasters (drought,weather extremes,etc.)
- Populations changes (immigration,new cultural groupings,etc.)

Description

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- Before-After (before and after program)
- During (during program)

Description

2. Data Collection Methods

- On-Site
- Other (Participation point charts)
- Portfolio Reviews
- Sampling

Description

V(A). Planned Program (Summary)

Program #4

1. Name of the Planned Program

Strategies to monitor and mitigate environmental impacts of agriculture.

2. Brief summary about Planned Program

The protection of surface water from agricultural pollutants continues to be a major challenge. As such, state and federal water quality regulatory agencies require that emphasis be placed on identifying and restoring impacted water bodies. Therefore, the assessment of streams, lakes and reservoirs requires sound monitoring strategies at the watershed scale. Phosphorus (P) and nitrogen (N) are essential nutrients for crop production. They are also the primary factors that enhance eutrophication. The USEPA has identified eutrophication as the most widespread water quality impairment in the United States, and agriculture as a major source of nutrient loading to surface waters. In middle Tennessee, large concentrations of nursery crop production operations exist in the Collins River watershed. Therefore, the potential for nutrient loading by overland and subsurface flow from these agricultural producers to the Collins River exists. The planned program uses a watershed-based approach and state-of-the-art technologies to evaluate the impacts of nursery crop production on soil and water quality of the Collins River basin. The data collected will be made available to growers and small-scale farmers in forums such as field days and nursery associations' conferences to inform growers of the impact of good and bad environmental stewardship on water quality. Additionally, the data will also be made available to state and local regulatory agencies to help in validating nutrient TMDL for the Collins River.

3. Program existence : Intermediate (One to five years)

4. Program duration : Medium Term (One to five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
112	Watershed Protection and Management				100%
	Total				100%

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Many states are concerned about the impact of non-point source pollution on the quality of surface water in their watersheds. Agricultural production contributes to non-point source pollution. The USEPA is now strictly enforcing provisions of the 1972 Federal Clean Water Act by ensuring that states implement a Total Maximum Daily Load (TMDL) for contaminants. In turn, many state regulatory agencies are promulgating laws to ensure that non-point source pollutants are assessed and regulated. Phosphorus (P) and nitrogen (N) are essential nutrients for crop production and are the primary factors contributing to eutrophication. In middle Tennessee, large concentrations of nursery crop production operations exist. The need to produce ornamental and nursery crops of high aesthetic quality has caused a heavy reliance on synthetic fertilizers. Additionally, in nursery crop production systems, non-target application of nursery fertilizer has been reported in published literature; this can result in the migration of the nutrients into water resources. There is a dearth of research on the impact of nursery crop production systems on surface water quality, thus growers are not aware of the impact of their fertilizer and lime management on surface waters, especially when most of the nursery fields lack nutrient management plans. The proposed program will assess nutrient loading from nursery fields and subsequently will help in the development of TMDL of nutrients in impaired water

bodies as well as in the development of nutrient management plans for nursery production operations.

2. Scope of the Program

- In-State Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

Agricultural producers will continue to use fertilizers to improve the quality of their nursery stock. Some of these substances will be detected in streams and lakes. To our knowledge, most growers are not aware of the impact of these chemicals in surface water. It is expected that the research conducted in this program will replace conjecture with sound data and therefore form the basis for scientifically sound recommendations for determining water protection policy. The planned program is an important advancement in pollution abatement strategy.

2. Ultimate goal(s) of this Program

To assess the concentration of essential nutrients of agricultural fertilizer and lime in surface water to provide needed information for developing Total Maximum Daily Load (TMDL) for essential crop nutrients; thus providing accurate data on which to develop nutrient management plans for nursery production operations.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2010	0.0	0.0	0.0	2.6
2011	0.0	0.0	0.0	2.6
2012	0.0	0.0	0.0	2.6
2013	0.0	0.0	0.0	2.6
2014	0.0	0.0	0.0	2.6

V(F). Planned Program (Activity)

1. Activity for the Program

Characterize sub-watershed. Assess concentrations of nitrogen, phosphorous, suspended sediments in streams in the Collins river basin. Provide experiential learning opportunities to TSU students. Communicate research findings to appropriate scientific and stakeholder groups.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> ● Other 1 (None, not an Extension program) 	<ul style="list-style-type: none"> ● Other 1 (None, not an Extension program)

3. Description of targeted audience

Nursery and other agricultural producers. Fertilizer producers. Regulatory and watchdog agencies.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0

2. (Standard Research Target) Number of Patent Applications Submitted

Expected Patent Applications

2010 :0 2011 :0 2012 :0 2013 :0 2014 :0

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2010	1	0	1
2011	1	0	1
2012	2	0	2
2013	1	0	1
2014	0	0	0

V(H). State Defined Outputs

1. Output Target

- Scientific publications pertaining to water quality measurement techniques and watershed analysis results

2010 :1 2011 :1 2012 :2 2013 :1 2014 :0

- Development of water quality analysis techniques

2010 :1 2011 :1 2012 :0 2013 :0 2014 :0

V(I). State Defined Outcome

O. No	Outcome Name
1	Increase in number of nursery producers with increased awareness of problem/situation
2	Number of water bodies removed from 303(d) list
3	Number of agricultural producers per year developing a nutrient management plan
4	Number of students per year gaining experiential learning in water quality analysis

Outcome #1

1. Outcome Target

Increase in number of nursery producers with increased awareness of problem/situation

2. Outcome Type : Change in Action Outcome Measure

2010 :10 **2011 :** 10 **2012 :** 10 **2013 :** 20 **2014 :** 0

3. Associated Institute Type(s)

•1890 Research

4. Associated Knowledge Area(s)

- 112 - Watershed Protection and Management

Outcome #2

1. Outcome Target

Number of water bodies removed from 303(d) list

2. Outcome Type : Change in Condition Outcome Measure

2010 : 0 **2011 :** 0 **2012 :** 0 **2013 :** 0 **2014 :** 1

3. Associated Institute Type(s)

•1890 Research

4. Associated Knowledge Area(s)

- 112 - Watershed Protection and Management

Outcome #3

1. Outcome Target

Number of agricultural producers per year developing a nutrient management plan

2. Outcome Type : Change in Action Outcome Measure

2010 : 2 **2011 :** 5 **2012 :** 10 **2013 :** 10 **2014 :** 10

3. Associated Institute Type(s)

•1890 Research

4. Associated Knowledge Area(s)

- 112 - Watershed Protection and Management

Outcome #4

1. Outcome Target

Number of students per year gaining experiential learning in water quality analysis

2. Outcome Type : Change in Knowledge Outcome Measure

2010 : 2 **2011 :** 2 **2012 :** 2 **2013 :** 2 **2014 :** 0

3. Associated Institute Type(s)

•1890 Research

4. Associated Knowledge Area(s)

- 112 - Watershed Protection and Management

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Competing Programmatic Challenges
- Appropriations changes
- Natural Disasters (drought,weather extremes,etc.)
- Government Regulations

Description

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- Before-After (before and after program)
- During (during program)
- Comparisons between different groups of individuals or program participants experiencing different levels of program intensity.
- Comparisons between program participants (individuals,group,organizations) and non-participants

Description

2. Data Collection Methods

- Mail
- Observation
- Sampling

Description

V(A). Planned Program (Summary)**Program #5****1. Name of the Planned Program**

Improving agricultural plants through reduced response to stress.

2. Brief summary about Planned Program

Stress can influence the severity of pathogen-induced infections of a host plant. Plants respond to stress by producing proteins that act as molecular chaperones (chaperonins) to protect other host proteins. However, the stress response of a plant may render it susceptible to diseases due to the ability of pathogens to exploit the presence of these host stress proteins. One portion of this planned program will explore the relationship between host stress proteins and pathogen infectivity. The molecular response of in vitro cultures of *Solanum* spp. to different temperature regimes will be identified. Control and in vitro experimental units subjected to temperature regimes that induce production of partial and complete sets of chaperonins will be exposed to necrotrophic pathogens (e.g. Pithium/Phytophthora). The degree of host susceptibility to the infection will be determined in presence and absence of host chaperonins. Production of host stress proteins will be blocked with anti-sense RNA to elucidate the relationship between the stress proteins and pathogen infectivity. The severity of infection will then be studied to develop strategies to co-manage stress and disease prevention in cultivated plants.

Another portion of the program will seek to mitigate the effects of high and low temperature stresses that adversely affect the growth and yield of agricultural crops. Several genes regulated by low and high temperature have been isolated during studies on molecular mechanisms of cold and heat tolerance in different plant species. This objective of this portion of the program is to test the function of these genes in sensitive plant species by making gene constructs with sense and anti-sense sequences of the genes and then incorporating these genes into tomatoes, which is sensitive to both low and high temperatures. The transgenic plants will be evaluated for resistance/tolerance to low temperature for seed germination, degree of damage to seedling and floral buds at 4 -10C. The heat tolerance will be evaluated for fruit setting and seeds development at 35-40C. Genes conferring tolerance in transgenic tomatoes will be available for transforming other plant species to improve their productivity under stress conditions.

3. Program existence : Intermediate (One to five years)

4. Program duration : Medium Term (One to five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
201	Plant Genome, Genetics, and Genetic Mechanisms				50%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants				15%
212	Pathogens and Nematodes Affecting Plants				25%
216	Integrated Pest Management Systems				10%
	Total				100%

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Plant stress response and the development of stress resistant crops are key to the sustainability of modern agriculture. High and low temperature stresses limit crop production area and yield, and crops that undergo stress are more susceptible to pathogen infection. Understanding the molecular basis of a pathogen's ability to exploit the stress response in plants will lead to the development of tools to reduce infections. The ability to reliably identify and manipulate genes responsible for tolerance to temperature extremes will improve agricultural production.

2. Scope of the Program

- In-State Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

Due to their affect on yield reduction and disease occurrence, environmental stresses, especially high and low temperatures will remain a priority item in agricultural research. Increasing and improving temperature tolerances in different plant species is the primary choice, and in some cases the only choice, to maintain the sustainability of agricultural production systems. The availability of gene resources with known functions will ensure the leading role of the US in agricultural research and production in the world. Environmental stresses induce the production of stress proteins that function as molecular chaperones to protect other host proteins. Host chaperonins may be recruited by pathogens to aid in the pathogen's survival and to inflict aggressive infectivity. Development of stress-resistant as well as disease-resistant plants will remain a priority.

2. Ultimate goal(s) of this Program

Investigate improved agricultural productivity via 1) genes that putatively will enhance resistance to low and high temperatures will be tested and characterized. The selected genes will be incorporated into important agricultural crops and 2) host stress proteins and pathogen infectivity interactions will be evaluated to elucidate the underlying mechanism(s) and thereby contribute to the development of integrated pest management strategies.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2010	0.0	0.0	0.0	4.0
2011	0.0	0.0	0.0	4.0
2012	0.0	0.0	0.0	4.0
2013	0.0	0.0	0.0	4.0
2014	0.0	0.0	0.0	4.0

V(F). Planned Program (Activity)**1. Activity for the Program**

Development of techniques to mitigate the exploitation of plant stress proteins by plants via research in the molecular response of plants to stress and subsequent pathogen establishment. Conduct gene expression research experiments, provide training for graduate students, develop products and services.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> ● Demonstrations 	<ul style="list-style-type: none"> ● Web sites

3. Description of targeted audience

Plant breeders, seed companies, scientific colleagues, extension personnel, plant pest management researchers and agricultural producers.

V(G). Planned Program (Outputs)**1. Standard output measures**

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0

2. (Standard Research Target) Number of Patent Applications Submitted**Expected Patent Applications**

2010 :0

2011 :0

2012 :1

2013 :1

2014 :0

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2010	2	0	2
2011	1	0	1
2012	1	0	1
2013	1	0	1
2014	1	0	1

V(H). State Defined Outputs

1. Output Target

- Techniques for inducing, detecting, and exploiting stress related proteins in plant disease resistance research.

2010 2 **2011** 0 **2012** :0 **2013** 0 **2014** 0

- Scientific publications concerning reduced response to stress.

2010 2 **2011** 1 **2012** :1 **2013** :1 **2014** :1

- Patents for temperature stress genes.

2010 0 **2011** 0 **2012** :1 **2013** :1 **2014** 0

- Temperature stress tolerant plant cultivars.

2010 :1 **2011** 0 **2012** :0 **2013** 0 **2014** :1

- Techniques to quantify heat and chilling stress tolerance in plants.

2010 :1 **2011** 0 **2012** :0 **2013** 0 **2014** 0

V(I). State Defined Outcome

O. No	Outcome Name
1	Number of integrated stress management and disease prevention strategies developed.
2	Number of molecular mechanisms for plant stress identified.
3	Additional number of students gaining knowledge about nexus of host stress and pathogen infectivity.
4	Number of additional growers, scientists and pest managers aware of issue.
5	Temperature stress tolerance genes identified.
6	Temperature stress tolerant plant cultivars developed.

Outcome #1**1. Outcome Target**

Number of integrated stress management and disease prevention strategies developed.

2. Outcome Type : Change in Action Outcome Measure

2010 :1 2011 : 1 2012 : 0 2013 0 2014 :0

3. Associated Institute Type(s)

•1890 Research

4. Associated Knowledge Area(s)

- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 212 - Pathogens and Nematodes Affecting Plants
- 216 - Integrated Pest Management Systems

Outcome #2**1. Outcome Target**

Number of molecular mechanisms for plant stress identified.

2. Outcome Type : Change in Knowledge Outcome Measure

2010 2 2011 : 0 2012 : 0 2013 0 2014 :0

3. Associated Institute Type(s)

•1890 Research

4. Associated Knowledge Area(s)

- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 212 - Pathogens and Nematodes Affecting Plants
- 216 - Integrated Pest Management Systems

Outcome #3**1. Outcome Target**

Additional number of students gaining knowledge about nexus of host stress and pathogen infectivity.

2. Outcome Type : Change in Knowledge Outcome Measure

2010 :1 2011 : 1 2012 : 1 2013 :1 2014 :0

3. Associated Institute Type(s)

•1890 Research

4. Associated Knowledge Area(s)

- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 212 - Pathogens and Nematodes Affecting Plants
- 216 - Integrated Pest Management Systems

Outcome #4**1. Outcome Target**

Number of additional growers, scientists and pest managers aware of issue.

2. Outcome Type : Change in Knowledge Outcome Measure

2010 :0

2011 : 60

2012 : 60

2013 : 60

2014 : 0

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 212 - Pathogens and Nematodes Affecting Plants
- 216 - Integrated Pest Management Systems

Outcome #5**1. Outcome Target**

Temperature stress tolerance genes identified.

2. Outcome Type : Change in Knowledge Outcome Measure

2010 :1

2011 : 1

2012 : 1

2013 : 1

2014 : 1

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 201 - Plant Genome, Genetics, and Genetic Mechanisms

Outcome #6**1. Outcome Target**

Temperature stress tolerant plant cultivars developed.

2. Outcome Type : Change in Action Outcome Measure

2010 :1

2011 : 0

2012 : 0

2013 : 1

2014 : 0

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 201 - Plant Genome, Genetics, and Genetic Mechanisms

V(J). Planned Program (External Factors)**1. External Factors which may affect Outcomes**

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Public Policy changes
- Competing Programmatic Challenges

Description**V(K). Planned Program (Evaluation Studies and Data Collection)****1. Evaluation Studies Planned**

- Before-After (before and after program)
- During (during program)
- Comparisons between different groups of individuals or program participants experiencing different levels of program intensity.
- Comparisons between program participants (individuals,group,organizations) and non-participants

Description

2. Data Collection Methods

- Observation
- Sampling
- Mail

Description

V(A). Planned Program (Summary)

Program #6

1. Name of the Planned Program

Research to mitigate food-borne illness.

2. Brief summary about Planned Program

Incidences of food-borne illness have prompted increased public health concerns. This Planned Program will utilize a number of different research avenues to address this problem: identification of the sources of contamination in the food harvest-to -consumption chain; development of improved food contamination detection technologies; and improving food-handling skills of consumers.

The occurrence of antibiotic resistant pathogenic microorganisms in farm environment and fresh produce will be ascertained and educational programs will be developed to communicate procedures to mitigate these sources of contamination. For the known pathogen Salmonella, a biosensor will be developed to permit rapid detection at all phases the food-handling chain. For other pathogens, risky food handling practices will be identified and the potential for cross contamination of foods within the home environment will be investigated. Following the identification of risk factors, targeted educational materials will be developed and made available to end-users.

3. Program existence : Intermediate (One to five years)

4. Program duration : Medium Term (One to five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
504	Home and Commercial Food Service				10%
602	Business Management, Finance, and Taxation				10%
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins				80%
	Total				100%

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Food borne illnesses impose a \$6.6 billion to \$37.1 billion cost on the US economy every year. Millions of consumers are sickened and hospitalized annually from food pathogens resulting in increased health care costs, lost wages, and lost productivity due to sicknesses. The prevention of food borne infection requires control measures at all stages of the food chain, from agricultural production, to processing, manufacturing, and preparation of foods in both commercial establishments and the domestic environment.

The presence of food borne pathogens in the fresh produce markets indicate a weakness in the nation's fresh produce

production standards, and has been demonstrated in recent multi-state outbreaks from contaminated produce. Cross contamination of fresh produce with pathogens may occur during the production cycle and can originate from soil, insects, equipment, animals or humans. Pathogen contaminated water or surface run-off waters can lead to cross-contamination of fruits and vegetables in the field. Prevention, early detection of pathogens, and control measures must be in place at every step of fresh produce production to help minimize food safety risks. Improvement in mitigation efforts pre- and post-harvest require a comprehensive understanding on the occurrence, profiles, and persistence of antibiotic resistant pathogens in the environment.

Due to the prevalence of Salmonella species in the food supply, routine and reliable monitoring for these pathogens is necessary to reduce their impact upon human health. Traditional testing methods involving enrichment, isolation, and biochemical characterization require 4 to 5 days to complete. Due to the perishable nature of many food items, a more rapid detection method is necessary to feasibly monitor the potential contaminations.

In the United States, interest in raising meat goat and guinea fowl as alternative livestock by small scale farmers has increased in the last few years. Intensive production, which is in most part associated with confinement, is a common practice. Such environmental conditions are quite conducive to proliferation of pathogenic microorganisms in these food animals. These microorganisms, such as Campylobacter in the case of poultry, can cause human illnesses through direct contact either in production or processing facilities or through consumption of contaminated animal products. Meat products such as goat can also be contaminated with Campylobacter which can contribute to human illness. Other risks include contact with untreated water and exposure to live birds. Little information is available on the potential for microbial contamination in alternative meat and poultry products.

Most costs associated with food borne pathogens are highly aggregated with costs for individual states submerged in this aggregation. These cost estimates will be critical in designing effective training and education that will adequately address the problem, setting the stage for policy recommendation(s).

2. Scope of the Program

- In-State Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

The current interest of local, regional and national governments to address food safety issues will continue to be of importance as costs of foodborne illnesses continue to impose heavy health, productivity and medical costs on society. As the economy expands, with more imports of food and food products and a increasingly integrated world economy, food safety problems will continue to be important.

The pathogen detection products to be developed, including the recombinant antibodies and the detection methodology, are of great interest to companies marketing diagnostic assays for foodborne pathogen detection. These methods will provide advanced detection techniques to food producers, processors and distributors, as well as federal and state health and regulatory agencies (USDA, FDA, and State Health Department) for surveillance and investigation of food safety problems.

Implementation of proper management practices in livestock production and in the home will minimize possible sources of microorganisms. Consumers will change risky behaviors if evidence is presented that current practices are not adequate or effective. Consumers in the needed demographic groups will give permission for data collection in the home.

The need for effective food safety policies will continue to exist. Research that leads to better policies regarding food safety will continue to provide the information needed in addressing these issues. The program also assumes that there will be reasonable cooperation from the small producers, food handlers and consumers.

The current structure of food harvesting and processing coupled with the threat of bioterrorism pose food safety issues to Tennessee and the nation. As long as these forces continue to impact the US economy, food safety issues will need to be constantly addressed with innovative ways to address problems that will continue to arise.

The program also assumes that there will be reasonable cooperation from the small producers, food handlers and consumers targeted for this project. Stakeholders will actively participate in the program and provide input to be integrated into the program.

2. Ultimate goal(s) of this Program

A safe food supply is an essential component for the development of human potential. The overall goal of this program is to reduce the incidence of food borne illness. Knowledge of what people eat and how they manage their food, especially how they store perishable and ready to eat foods to keep them safe, will help achieve this goal. Additionally, this program will identify risky behaviors and potential sources of food contamination with the goal of developing relevant educational materials to reduce these behaviors. Data on the prevalence and types of antibiotic resistant microorganisms isolated from fresh produce will also be obtained and may help explicate the role of foods in the transmission of antibiotic-resistant strains to human populations. The program will provide food safety and safe food handling education and training to targeted groups and others interested in food

safety. Finally, the development of advanced surveillance technology for use by food safety inspectors, meat and poultry producers/processors will facilitate the identification and elimination of the risk of contaminations.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2010	0.0	0.0	0.0	4.3
2011	0.0	0.0	0.0	4.3
2012	0.0	0.0	0.0	4.3
2013	0.0	0.0	0.0	4.3
2014	0.0	0.0	0.0	4.3

V(F). Planned Program (Activity)

1. Activity for the Program

Analyze survey data on consumer transportation, usage and storage of foods to identify risky behaviors and assess potential for cross contamination. Perform microbial analysis of samples collected from meat, poultry, food samples, packages and home refrigerators. Obtain data on the prevalence and types of antibiotic resistant microorganisms isolated from fresh produce. Develop strategies to minimize potential for food borne illness originating from improper food handling and animal management practices. Conduct laboratory experiments to develop a biosensor. Conduct field trials to evaluate the biosensor. Transfer the developed technology to end users.

Design a survey for collecting primary information from consumers, small producers and selected food handlers. Design training/education strategies and materials. Construct and review sound experimental design for the study and explore analytical and statistical method(s) for analyzing data to be collected. Analyze collected data and draw conclusions. Develop policy implication and recommendation. Develop strategies for communicating findings to stakeholders and policy makers.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> ● Demonstrations 	<ul style="list-style-type: none"> ● Web sites

3. Description of targeted audience

Food processors, packaged foods industry, agricultural producers and alternative meat and poultry producers, consumers, risk assessment agencies, food scientists.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0

2. (Standard Research Target) Number of Patent Applications Submitted

Expected Patent Applications

2010 :0 2011 :0 2012 :0 2013 :0 2014 :0

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2010	3	0	3
2011	3	0	3
2012	2	0	2
2013	2	0	2
2014	1	0	1

V(H). State Defined Outputs

1. Output Target

- Creation of a database which can be used in risk assessment exercises to elucidate the role of raw produce in the dissemination of antibiotic resistance to human populations.

2010 :1 2011 :0 2012 :0 2013 :0 2014 :0

- Hygienic handling practices identified and developed for communication to target producers and consumers.

2010 :1 2011 :2 2012 :1 2013 :1 2014 :0

- Profiles of antibiotic resistance in fresh produce determined.

2010 :1 2011 :1 2012 :0 2013 :0 2014 :0

- Commercializable diagnostic assay for rapid detection of Salmonella in food.

2010 :0 2011 :1 2012 :0 2013 :0 2014 :0

- Publications relating to rapid detection of Salmonella in foods.

2010 :1 2011 :1 2012 :0 2013 :0 2014 :0

- Bulletin publications concerning the current and future status of food safety in Tennessee.

2010	2011	2012	2013	2014
1	0	:1	0	0
● Consumer education materials in food handling practices				
:10	0	:0	0	0
● Microbial profile of meat goat carcasses				
1	0	:0	0	0
● Microbial profile of guinea fowl carcasses				
1	0	:0	0	0

V(I). State Defined Outcome

O. No	Outcome Name
1	Total percentage of target consumers educated on safer ways of handling fresh produce.
2	Percentage of target producers using safe agricultural practices (wise use of antibiotics in farm) production.
3	New technologies developed to detect Salmonella in foods.
4	Transfer of new Salmonella detection procedures to commercial food industry.
5	Number of people with increased knowledge of sources, estimated cost and recommendations concerning food borne illness in Tennessee.
6	Number of consumers applying knowledge from education and training.
7	Number of small producers applying knowledge from education and training.
8	Percentage of producers that will change production practices to reduce contamination of meat goat and guinea fowl
9	Percentage of targeted consumers that will be following best management practices for reducing microbial contamination.

Outcome #1

1. Outcome Target

Total percentage of target consumers educated on safer ways of handling fresh produce.

2. Outcome Type : Change in Knowledge Outcome Measure

2010 :10 **2011** : 20 **2012** : 40 **2013** 50 **2014** :60

3. Associated Institute Type(s)

•1890 Research

4. Associated Knowledge Area(s)

- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #2

1. Outcome Target

Percentage of target producers using safe agricultural practices (wise use of antibiotics in farm) production.

2. Outcome Type : Change in Action Outcome Measure

2010 30 **2011** : 40 **2012** : 50 **2013** 70 **2014** :70

3. Associated Institute Type(s)

•1890 Research

4. Associated Knowledge Area(s)

- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #3

1. Outcome Target

New technologies developed to detect Salmonella in foods.

2. Outcome Type : Change in Action Outcome Measure

2010 0 **2011** : 1 **2012** : 0 **2013** 0 **2014** :0

3. Associated Institute Type(s)

•1890 Research

4. Associated Knowledge Area(s)

- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #4

1. Outcome Target

Transfer of new Salmonella detection procedures to commercial food industry.

2. Outcome Type : Change in Condition Outcome Measure

2010 0 **2011** : 1 **2012** : 0 **2013** 0 **2014** :0

3. Associated Institute Type(s)

•1890 Research

4. Associated Knowledge Area(s)

- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #5

1. Outcome Target

Number of people with increased knowledge of sources, estimated cost and recommendations concerning food borne illness in Tennessee.

2. Outcome Type : Change in Knowledge Outcome Measure

2010 50 **2011** : 50 **2012** : 50 **2013** 50 **2014** :50

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 504 - Home and Commercial Food Service
- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #6

1. Outcome Target

Number of consumers applying knowledge from education and training.

2. Outcome Type : Change in Action Outcome Measure

2010 50 **2011** : 50 **2012** : 50 **2013** 50 **2014** :50

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 504 - Home and Commercial Food Service
- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #7

1. Outcome Target

Number of small producers applying knowledge from education and training.

2. Outcome Type : Change in Action Outcome Measure

2010 25 **2011** : 30 **2012** : 30 **2013** 0 **2014** :0

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 504 - Home and Commercial Food Service
- 602 - Business Management, Finance, and Taxation
- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #8

1. Outcome Target

Percentage of producers that will change production practices to reduce contamination of meat goat and guinea fowl

2. Outcome Type : Change in Knowledge Outcome Measure

2010 :15 2011 : 5 2012 : 0 2013 0 2014 :0

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #9

1. Outcome Target

Percentage of targeted consumers that will be following best management practices for reducing microbial contamination.

2. Outcome Type : Change in Action Outcome Measure

2010 20 2011 : 30 2012 : 35 2013 40 2014 :0

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 504 - Home and Commercial Food Service
- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Competing Programmatic Challenges
- Government Regulations
- Appropriations changes

Description

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- Comparisons between different groups of individuals or program participants experiencing different levels of program intensity.
- Before-After (before and after program)
- During (during program)
- Comparisons between program participants (individuals,group,organizations) and non-participants

Description

2. Data Collection Methods

- Mail
- Sampling
- Observation

Description

V(A). Planned Program (Summary)

Program #7

1. Name of the Planned Program

Reducing plant pest problems in the green industry using environmentally sound methods.

2. Brief summary about Planned Program

This program emphasizes applied research as a means to mitigate pathological and entomological problems facing the regional nursery plant production industry by developing new methods for the use of traditional pesticides and the development and use of biological pesticides and integrated pest management systems. The desired result is a reduction in the economic impact of plant insects and diseases while minimizing or negating environmental and/or worker exposure risk.

3. Program existence : Intermediate (One to five years)

4. Program duration : Medium Term (One to five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
133	Pollution Prevention and Mitigation				5%
211	Insects, Mites, and Other Arthropods Affecting Plants				50%
212	Pathogens and Nematodes Affecting Plants				15%
215	Biological Control of Pests Affecting Plants				30%
	Total				100%

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Due to the high cash value of woody ornamentals, chemical pesticides are routinely used to control diseases and insects; however, this increases production costs, increases the potential for environmental contamination and increases safety concerns over accidental exposures to hazardous chemicals. There are many different genera and species of pathogens that attack nursery crops. Some of the pathogens may interact to produce disease complexes that may be difficult to control with a single chemical.

Invasive insects are also a threat to the sustainability of the US nursery industry. Due to the negative aspects associated with invasive insects, federal and state quarantines are routinely imposed to prevent the artificial movement of these insects into new regions. Quarantines generally require the use of insecticides to certify nursery plants free of invasive insects.

Unfortunately, treatment options are often limited to only a few active ingredients that have undergone rigorous certification

testing. In situations where only a few insecticide options are available, the ability of nursery growers to ship their plants may be seriously jeopardized if the insecticide becomes unavailable. Likewise, producers may have little flexibility in the selection of low cost insecticides or active ingredients that are safer to handlers.

Additionally, most insecticide treatments currently available to the nursery industry as well as residential, institutional, and public entities, have broad-spectrum activity on many arthropod species. The widespread use of general insecticides has brought with it environmental and human health concerns including: pesticide contamination of rivers and streams via runoff from treated fields and nurseries; drinking water contamination from the infiltration of pesticides through the soil; and the destruction of wildlife and beneficial insects and mites.

Environmental regulations governing the quality of water emissions from nurseries are becoming more stringent. In addition, exposure of farm labor to toxic pesticides is always an issue of concern. Alternative biopesticide treatments are one option that could allow nursery producers to manage their pest and disease problems, while at the same time providing good environmental stewardship and reducing the pesticide exposure risk for farm labor.

The identification of multiple pesticide alternatives, improved rates, and safer handling methodologies will give growers greater latitude in pesticide selection, reduce their costs, be safer for workers and the environment and allow continued shipment of their plant commodities.

2. Scope of the Program

- In-State Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

Imported fire ants (IFA) and Japanese beetle (JB) are major threats to the economic viability of the U.S. nursery industry. In Tennessee, IFA and JB quarantines impact ~ 80% and 20% of total plant sales, respectively. IFA treatment development has primarily targeted container nurseries, resulting in few viable options for major field nursery states like Tennessee and North Carolina. Chlorpyrifos is the main field nursery quarantine treatment. The proposed project assumes that imported fire ant-produced semiochemicals such as alarm and aggregation pheromones as well as plant-produced kairomones can be isolated and identified; that these chemicals can be enhanced for longevity under field conditions; that the chemicals can be used to attract foraging imported fire ants to the toxic baits; and can be used to disrupt imported fire ant colonies without adverse effects to the environment. This study assumes new insecticide treatments can be identified that will provide quarantine level management of both IFA and JB. The work proposed assumes a cost reduction for growers will be achieved as more insecticide options are available and lower rates are identified. The proposed study assumes grower labor costs can be reduced by improved application methodologies.

Hydrangea has emerged as an important ornamental plant; foliage diseases such as powdery mildew and cercospora leaf spot are the two most important diseases of hydrangea. Although many cultivars are available to nursery growers and the landscape industry, there is no centralized data on the relative resistance or susceptibility of commercial cultivars to the two most important diseases. It is reasonable to assume that commercial cultivars exhibit different levels of susceptibility.

Although Phytophthora is the best known soil borne pathogen, specific species affecting different ornamental plants are not well documented. Phytophthora species differ in their life cycles and stages in which they are vulnerable for disease intervention. There are more than 50 species of Phytophthora and information on the identity of species important in woody ornamentals will enhance the development of disease management strategies.

The proposed project assumes that new biopesticide treatments can be identified, field enhanced for longevity, and that impacts on the environment and plant growth can be measured. A major limitation to widespread usage of biopesticides is their short field longevity, which may be remedied by enhancements in formulation. The work proposed assumes biopesticide treatments can be developed that will offer growers pest management equivalent to conventional pesticides. At the same time, it is assumed growers will benefit from less regulatory action on their environmental inputs and safer treatments for farm labor.

2. Ultimate goal(s) of this Program

The goals of this program are 1) the development of environmentally sound, economically feasible, and worker friendly treatments for nursery production practices that the US nursery industry can use to reduce insect and disease problems to levels below the economic threshold and/or which meet state and federal quarantine requirements; and 2) environmental protection and enhancement through the development of treatments and technologies for managing invasive biotic threats to agricultural and forest resources.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2010	0.0	0.0	0.0	14.4
2011	0.0	0.0	0.0	14.4
2012	0.0	0.0	0.0	14.4
2013	0.0	0.0	0.0	14.4
2014	0.0	0.0	0.0	14.4

V(F). Planned Program (Activity)

1. Activity for the Program

Research experiments with approved and experimental insecticide compounds will be conducted that will lead to new or improved fire ant and Japanese beetle quarantine treatments for field nursery plants. The research will expand grower options in the Federal Imported Fire Ant Quarantine and the U.S. Domestic Japanese Beetle Harmonization Plan. The TSU Entomology Program will partner with USDA-ARS and USDA-APHIS collaborators to achieve these outcomes. This program will also perform research to identify powdery mildew resistance, resistance to cercospora leafspot/blight, and to identify and catalog soil-borne pathogens prevalent in the Tennessee nursery industry.

Additionally, new biopesticide compounds that can manage soil-borne pathogen and insect problems in container nurseries will be developed. The research will be used to expand grower options and offer alternatives that are safer for farm labor and the environment. In addition to finding and developing alternative pest management options, we intend to demonstrate that a significant reduction in offsite environmental contamination can be accomplished by grower adoption of biopesticide pest management options.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> ● Demonstrations 	<ul style="list-style-type: none"> ● Web sites

3. Description of targeted audience

Nursery producers. Policy makers for regulatory pests like fire ants (e.g., regulatory entities involved with decision making on quarantine treatment approval). Pesticide and chemical manufacturers, agricultural research community, Extension agents, parks, schools.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0

2. (Standard Research Target) Number of Patent Applications Submitted

Expected Patent Applications

2010 :0 2011 :0 2012 :1 2013 :0 2014 :0

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2010	3	0	3
2011	4	0	4
2012	3	0	3
2013	3	0	3
2014	1	0	1

V(H). State Defined Outputs

1. Output Target

- Scientific publications pertaining to reducing plant pest problems in the green industry using environmentally sound methods.

2010 3 2011 4 2012 3 2013 4 2014 1

- New techniques for control of Japanese beetle and imported fire ant.

2010 0 2011 1 2012 0 2013 1 2014 0

V(I). State Defined Outcome

O. No	Outcome Name
1	Increase in number of growers with increased awareness of program issues.
2	Percentage of nurseries adopting fire ant control strategies using newly discovered chemicals.
3	Number of educational trade articles to increase grower awareness.
4	Development of an improved treatment method for Japanese beetle and imported fire ant.
5	Approval of new insecticides or lower rates of existing insecticides in Fire Ant and Japanese Beetle quarantines.
6	Increase in number of growers aware of newly identified disease resistant cultivars
7	Increase in number of growers aware of causes of disease and pathogen survival
8	Increase in number of growers aware of soil-borne disease prevention methods
9	Increase in number of Tennessee growers aware of disease resistant hydrangea cultivars
10	Number of new biopesticide treatments developed
11	Percent reduction in pesticide movement offsite of research facility

Outcome #1**1. Outcome Target**

Increase in number of growers with increased awareness of program issues.

2. Outcome Type : Change in Knowledge Outcome Measure

2010 :150 2011 : 150 2012 : 150 2013 :100 2014 :0

3. Associated Institute Type(s)

•1890 Research

4. Associated Knowledge Area(s)

- 133 - Pollution Prevention and Mitigation
- 211 - Insects, Mites, and Other Arthropods Affecting Plants

Outcome #2**1. Outcome Target**

Percentage of nurseries adopting fire ant control strategies using newly discovered chemicals.

2. Outcome Type : Change in Action Outcome Measure

2010 :5 2011 : 5 2012 : 5 2013 :0 2014 :0

3. Associated Institute Type(s)

•1890 Research

4. Associated Knowledge Area(s)

- 211 - Insects, Mites, and Other Arthropods Affecting Plants

Outcome #3**1. Outcome Target**

Number of educational trade articles to increase grower awareness.

2. Outcome Type : Change in Knowledge Outcome Measure

2010 :1 2011 : 1 2012 : 0 2013 :1 2014 :0

3. Associated Institute Type(s)

•1890 Research

4. Associated Knowledge Area(s)

- 211 - Insects, Mites, and Other Arthropods Affecting Plants

Outcome #4**1. Outcome Target**

Development of an improved treatment method for Japanese beetle and imported fire ant.

2. Outcome Type : Change in Action Outcome Measure

2010 :0 2011 : 1 2012 : 0 2013 :1 2014 :0

3. Associated Institute Type(s)

•1890 Research

4. Associated Knowledge Area(s)

- 211 - Insects, Mites, and Other Arthropods Affecting Plants

Outcome #5

1. Outcome Target

Approval of new insecticides or lower rates of existing insecticides in Fire Ant and Japanese Beetle quarantines.

2. Outcome Type : Change in Condition Outcome Measure

2010 : 0 **2011 :** 1 **2012 :** 1 **2013 :** 0 **2014 :** 0

3. Associated Institute Type(s)

•1890 Research

4. Associated Knowledge Area(s)

- 211 - Insects, Mites, and Other Arthropods Affecting Plants

Outcome #6

1. Outcome Target

Increase in number of growers aware of newly identified disease resistant cultivars

2. Outcome Type : Change in Knowledge Outcome Measure

2010 : .75 **2011 :** .75 **2012 :** 125 **2013 :** .150 **2014 :** 0

3. Associated Institute Type(s)

•1890 Research

4. Associated Knowledge Area(s)

- 212 - Pathogens and Nematodes Affecting Plants

Outcome #7

1. Outcome Target

Increase in number of growers aware of causes of disease and pathogen survival

2. Outcome Type : Change in Knowledge Outcome Measure

2010 : .75 **2011 :** .75 **2012 :** 100 **2013 :** .100 **2014 :** 0

3. Associated Institute Type(s)

•1890 Research

4. Associated Knowledge Area(s)

- 212 - Pathogens and Nematodes Affecting Plants

Outcome #8

1. Outcome Target

Increase in number of growers aware of soil-borne disease prevention methods

2. Outcome Type : Change in Knowledge Outcome Measure

2010 : .75 **2011 :** 100 **2012 :** 100 **2013 :** .100 **2014 :** 100

3. Associated Institute Type(s)

•1890 Research

4. Associated Knowledge Area(s)

- 212 - Pathogens and Nematodes Affecting Plants

Outcome #9

1. Outcome Target

Increase in number of Tennessee growers aware of disease resistant hydrangea cultivars

2. Outcome Type : Change in Knowledge Outcome Measure

2010 50 **2011** : 50 **2012** : 50 **2013** 50 **2014** :0

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 212 - Pathogens and Nematodes Affecting Plants

Outcome #10

1. Outcome Target

Number of new biopesticide treatments developed

2. Outcome Type : Change in Knowledge Outcome Measure

2010 :1 **2011** : 0 **2012** : 0 **2013** 0 **2014** :0

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 133 - Pollution Prevention and Mitigation
- 215 - Biological Control of Pests Affecting Plants

Outcome #11

1. Outcome Target

Percent reduction in pesticide movement offsite of research facility

2. Outcome Type : Change in Condition Outcome Measure

2010 0 **2011** : 0 **2012** : 20 **2013** 40 **2014** :0

3. Associated Institute Type(s)

- 1890 Research

4. Associated Knowledge Area(s)

- 133 - Pollution Prevention and Mitigation

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Government Regulations
- Natural Disasters (drought,weather extremes,etc.)

Description

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- Comparisons between different groups of individuals or program participants experiencing different levels of program intensity.
- Comparisons between program participants (individuals,group,organizations) and non-participants
- During (during program)
- Before-After (before and after program)

Description

2. Data Collection Methods

- Observation
- Mail
- Sampling

Description