

2009 Tennessee State University Research Annual Report of Accomplishments and Results

Status: Accepted

Date Accepted: 06/15/2010

I. Report Overview

1. Executive Summary

This report consists of the FY 2009 results and accomplishments of the Tennessee State University School of Agriculture and Consumer Sciences. In the attached report you will see that agricultural research at TSU is heavily aligned with the research goals outlined by NIFA, with productive research in all five areas. The program titles have been modified to illustrate the NIFA goal which is addressed in each particular program. Overall, the goal of agriculture research at TSU remains the same: to generate and communicate new scientific knowledge in the agricultural and environmental sciences for the prosperity of the citizens of Tennessee, the nation and the world.

The School of Agriculture and Consumer Sciences is staffed by dedicated faculty and staff who have received their education and training from many of the best institutions and training centers in the United States and in several countries around the world. This group of individuals takes pride in partnering with NIFA to advance the agricultural and environmental research at Tennessee State University and make a positive difference in our society. The research detailed in this report illustrates our commitment to educating our students, serving our stakeholders and bettering the lives of the world's citizens.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	62.5
Actual	0.0	0.0	0.0	59.9

II. Merit Review Process

1. The Merit Review Process that was Employed for this year

- Internal University Panel
- External University Panel

2. Brief Explanation

Each Planned Program in this Annual Report 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 have been developed to assure that approved programs are periodically reviewed to ensure they are meeting goals and remaining relevant: prior to the initiation of research projects/programs, researchers initiate and 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 during research projects researchers initiate contact with appropriate stakeholders to evaluate the degree of program/project success. An administrator within the School of Agriculture and Consumer Sciences meets with every project leader semiannually to monitor the progress of the planned programs. If the program is not progressing as planned, appropriate remedial steps are initiated. We feel that these procedures will contribute significantly to ensuring the Planned Programs are executed completely and with maximum benefit to stakeholders.

III. Stakeholder Input

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

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

Brief explanation.

When appropriate to the project, either community groups, industry associations or individual stakeholders were contacted and solicited for participation. For example, our research programs relating to environmental concerns works 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. In projects that have clientele who are low income and have young children, agencies such as Head Start, Habitat for Humanity, and Good Food for Good People were involved. In programs where needs were more commodity-based, trade organizations (i.e. Tennessee Nursery and Landscape Association, Tennessee Goat Producers Association, Guinea Fowl Breeders Association) were contacted and utilized for input and direction. In other cases, individuals were contacted and participation was requested. For much of the research in the area of nursery plants, surveys of nursery producers were performed and periodic meetings were held with a Nursery Advisory Group that is maintained by the University.

2(A). A brief statement of the process that was 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 Advisory Committees
- Use Internal Focus Groups
- Needs Assessments
- Use Surveys
- Other (See explanation below.)

Brief explanation.

The methods used for identifying stakeholders vary, depending upon the program. We try to identify stakeholders in a manner that will lead to the most useful and accurate feedback about stakeholder concerns as possible. Groups that serve the stakeholders (community based groups) or groups that represent stakeholders (industry and trade associations) are a primary source of input. Individuals are utilized where there are no associated groups representing the program area, or when an opportunity for face-to-face interaction (i.e. at an association meeting, field site visit, or community event) is presented. In these cases, individuals involved the program outputs are identified and queried for input.

2(B). A brief statement of the process that was 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

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

Brief explanation.

Most stakeholder input is collected in either face-to-face discussions or via survey instruments. Each of these methods is effective. The face-to-face discussions are often held with community group or trade association

representatives, or with individual stakeholders in a group setting, this allows for questions and answers to direct and stimulate discussion of areas of importance to stakeholders. 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 (often resulting in increased participation), a survey instrument does not always 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.

Stakeholder input is used on many levels in research projects. It is used to determine priority areas of research, the manner in which research is conducted, and how research results are communicated.

Brief Explanation of what you learned from your Stakeholders

An overarching theme from stakeholders, regardless of area of research, has been one of economics: How do we maximize profits? How do we minimize expenses? How do we produce our goods with fewer inputs? How do we get done what we need to get done with less money? Much of our research, regardless of topic or emphasis, has these lessons in economy woven through them.

In addition to the economic issues, we have learned that our stakeholders:

- 1) Want educational materials in multiple languages. As a result, we have brochures in English and Kurdish, and English and Spanish.
- 2) Older adults do not like web-based educational materials.
- 3) In-person activities are preferred to telephone, mail, or web-based items. On the other hand, it is hard to get them to participate in anything that is long.
- 4) Health professionals are the most trusted source of food safety and nutrition information.
- 5) Consumers do not participate in activities just to learn something. They do it more for socialization and to please those who ask them to participate.
- 6) It takes a lot of convincing to get consumers to change anything they are doing. Repetition and demonstration are important.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	2924127

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	0	0	0	1807497
Actual Matching	0	0	0	950911
Actual All Other	0	0	0	2913635
Total Actual Expended	0	0	0	5672043

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from				
Carryover	0	0	0	856586

V. Planned Program Table of Content

S. No.	PROGRAM NAME
1	Food Safety - developing a recombinant antibody based biosensor for rapid detection of salmonella
2	Food safety: reducing risk of food borne illness by characterizing food pathogens
3	Food Safety: reducing the costs of food borne illnesses to producers, food handlers and consumers
4	Food Safety: characterization of antibiotic resistant food borne pathogens in fresh produce
5	Childhood Obesity: improving limited resource families through improved nutrition and well-being
6	Climate Change: assessment of nutrients in the Collins River basin
7	Global Food Security and Hunger: evaluation of pathogen infectivity in stressed plants.
8	Global Food Security and Hunger: strategies to improve meat goat and guinea fowl production
9	Global Fod Security and Hunger: strategies to improve growth and performance of guinea fowl
10	Global Food Security and Hunger: doe reproductive output, fitness and longevity in meat goat breeds
11	Global Food Security and Hunger: molecular approaches for the study of leaf surface microorganisms
12	Global Food Security and Hunger: functional studies on cold and heat-regulated genes
13	Global Food Security and Hunger: Biopesticides to control disease & insect and improve water quality
14	Global Food Security and Hunger: management of quarantine insects in field nursery production
15	Global Food Security and Hunger: collection & evaluation of Goldenseal with superior properties
16	Global Food Security and Hunger: pathology research to benefit ornamental producers
17	Global Food Security and Hunger: controlling imported fire ants using behavior modifying chemicals
18	Global Food Security and Hunger: evaluation and characterization of heirloom vegetable varieties
19	Analyzing the green industry and related sub-sectors in Tennessee: challenges and prospects
20	Impact of the tobacco buyout program and strategies to promote economic viability of small farmers
21	Evaluation of poinsettias and seasonal alternative crops for production in Tennessee
22	Evaluating strategies to promote the goat meat industry in Tennessee

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

Food Safety - developing a recombinant antibody based biosensor for rapid detection of salmonella

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins				100%
	Total				100%

V(C). Planned Program (Inputs)**1. Actual amount of professional FTE/SYs expended this Program**

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	2.1
Actual	0.0	0.0	0.0	2.4

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	72542
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	38164
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	116935

V(D). Planned Program (Activity)**1. Brief description of the Activity**

Conduct laboratory experiments to develop a biosensor
 Conduct field trials to evaluate the biosensor
 Transfer the developed technology to end users

2. Brief description of the target audience

Food processors
 Packaged foods industry

V(E). Planned Program (Outputs)

1. Standard output measures

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	0	0	0	0
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2009

Plan: 0

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2009	Extension	Research	Total
Plan	0	1	
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

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

Year	Target	Actual
2009	1	1

Output #2

Output Measure

- Publications relating to rapid detection of Salmonella in foods

Year	Target	Actual
2009	1	1

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Scientific publications concerning rapid detection of Salmonella in foods
2	New technologies developed to detect Salmonella in foods
3	Transfer of new Salmonella detection procedures to commercial food industry

Outcome #1

1. Outcome Measures

Scientific publications concerning rapid detection of Salmonella in foods

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	1	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Salmonella is a major cause of food poisoning associated with animal and dairy products. New detection technology will facilitate regulatory agencies, meat and poultry producers/processors to efficiently detect and ultimately eliminate Salmonella from the food supplies.

What has been done

Seven recombinant monoclonal antibodies against flagellar antigens have been developed and applied to a surface plasmon resonance biosensor for rapid detection of Salmonella typhimurium. Antigenic specificity of the antibodies has been characterized by enzyme-linked immunosorbent assay and 2-D gel electrophoresis followed by Western blot.

Results

The antibodies bound specifically to the flagellar strain of Salmonella typhimurium. These antibodies recognized various epitopes present on a group of proteins migrating between 56 and 58 kD, with an isoelectric point of 5.2. The results suggested that the antibodies produced in this project are valuable structural probes for developing biosensors for detection of Salmonella.

4. Associated Knowledge Areas

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #2

1. Outcome Measures

New technologies developed to detect Salmonella in foods

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	1	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Surface plasmon resonance sensors capable of monitoring biomolecular interactions in real time provide promising features for developing new technologies to be used by regulatory agencies, meat and poultry producers/processors for rapid detection of Salmonella.

What has been done

Instrumentation of the surface plasmon resonance sensor has been reconfigured to a three-channel device; each channel has individual fluid control system. With this upgrading, the sensor is capable for multiple sample analysis. Experiments were conducted to test two chemical methods for immobilization of antibodies to the sensor surface. The sensitivity and specificity of the sensor were optimized using serial dilutions of the antibodies. Experiments were also conducted to evaluate performance of the sensor using analytical protocols with or without acid extraction procedures.

Results

The sensor detected Salmonella typhimurium at the level of 5x10⁶ colony forming units (CFU)/ml from an enriched culture. A detection limit of 2x10⁴ CFU/ml was achieved when an acid extraction procedure was applied before the sensor detection. Continuous monitoring with negative samples did not require regeneration of sensor surface. The same sensor could be regenerated for more than 50 times and the responses in the middle log-linear range remained above 92% of the initial level.

4. Associated Knowledge Areas

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #3

1. Outcome Measures

Transfer of new Salmonella detection procedures to commercial food industry

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	1	1

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

The sensor is intended to be used by regulatory agencies, meat and poultry producers/processors to facilitate identifying and eliminating risk of Salmonella contaminations.

What has been done

This project addresses an important issue in reducing microbial contamination during production and processing by improving the current surveillance technology. The technologies developed in this project were promoted to interested industrial professional at the Institute of Food Technologists Annual Meeting and Food Expo.

Results

The surface plasmon resonance sensor provides a smaller, inexpensive, and portable device for field applications and an optical design that allows simultaneous analysis of arrayed samples.

The sensor and the analytical protocols developed in this project have been tested and can be readily adapted as a rapid identification method by food produces and processors, with minor modification and some instrument investments.

4. Associated Knowledge Areas

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

V(H). Planned Program (External Factors)**External factors which affected outcomes**

- Appropriations changes
- Government Regulations
- Competing Programmatic Challenges

Brief Explanation

{No Data Entered}

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

1. Evaluation Studies Planned

- Retrospective (post program)
- During (during program)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

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

Food safety: reducing risk of food borne illness by characterizing food pathogens

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 Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins				10%
712					90%
	Total				100%

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	2.7
Actual	0.0	0.0	0.0	2.3

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	69519
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	36573
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	112063

V(D). Planned Program (Activity)

1. Brief description of the Activity

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. Develop strategies to minimize potential for food borne illness originating from improper food handling and animal management practices.

2. Brief description of the target audience

Alternative meat and poultry producers, consumers, risk assessment agencies.

V(E). Planned Program (Outputs)

1. Standard output measures

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	0	0	0	0
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2009

Plan: 0

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2009	Extension	Research	Total
Plan	0	1	
Actual	0	1	1

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Scientific publications concerning parameters for food borne illness transmission and mitigation

Year	Target	Actual
2009	1	1

Output #2

Output Measure

- Consumer education materials in food handling practices

Year	Target	Actual
2009	15	7

Output #3

Output Measure

- Complete microbial profile of home refrigerators

Year	Target	Actual
2009	1	1

Output #4

Output Measure

- Microbial profile of meat goat carcasses

Year	Target	Actual
2009	0	0

Output #5

Output Measure

- Microbial profile of guinea fowl carcasses

Year	Target	Actual
2009	0	0

Output #6

Output Measure

- Strategies for improved management practices

Year	Target	Actual
2009	1	0

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Additional percentage of consumers who will change their knowledge of best cleanliness practices
2	Percentage of targeted consumers that will be following best management practices for reducing microbial contamination
3	Percentage of producers will change production practices to reduce contamination of meat goat and guinea fowl

Outcome #1**1. Outcome Measures**

Additional percentage of consumers who will change their knowledge of best cleanliness practices

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	10	30

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Unclean kitchen surfaces can lead to cross-contamination during food preparation.

What has been done

A survey was conducted (n=150) to measure the frequency of and methods used to clean kitchen surfaces. Seven lessons on food safety, including recommendations on cleaning and sanitizing were developed and distributed. Microbial assessment of kitchen surfaces and cooking utensils were completed.

Results

Food preparers were unaware of the high microbial load of sponges and dishcloths. Thus, they learned ways to sanitize them regularly; they also said they would replace the sponges more often. Few knew how to prepare a sanitizing station, so were glad to receive that information. However, most said they were not likely to take the refrigerator apart inside and clean them thoroughly each week.

4. Associated Knowledge Areas

KA Code	Knowledge Area
504	Home and Commercial Food Service
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #2**1. Outcome Measures**

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

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	10	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Eating foods that have not been properly cleaned or are not cooked properly increases the chances of an individual getting sick from eating that food.

What has been done

An additional four thousand copies of a fruit and vegetable booklet recommending cleanliness practices for fruits produce were distributed. A pretest was conducted with 352 older adults to measure their food safety practices. A comprehensive educational booklet was sent to those who agreed to be in the follow-up study (n=180). Post tests wee mailed out and returned by 153 seniors.

Results

Extension agents who used the booklet for instruction report great satisfaction with the content. While consumers say they will follow the recommendations made, we have not assessed actual compliance. A greater percentage of seniors reported they thawed meat in the refrigerator, re-heated leftovers to boiling or steaming, cooked eggs until firm, used a meat thermometer and ate or discarded luncheon meats within five days of opening.

4. Associated Knowledge Areas

KA Code	Knowledge Area
504	Home and Commercial Food Service
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #3

1. Outcome Measures

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

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
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2009

10

0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Using unsafe sanitary practices while processing meat and poultry increases the likelihood that the resulting products may be contaminated procedures.

What has been done

Producer education has not yet begun.

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Competing Public priorities

Brief Explanation

{No Data Entered}

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

1. Evaluation Studies Planned

- Retrospective (post program)
- During (during program)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)**Program # 3****1. Name of the Planned Program**

Food Safety: reducing the costs of food borne illnesses to producers, food handlers and consumers

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				20%
602	Business Management, Finance, and Taxation				30%
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins				50%
	Total				100%

V(C). Planned Program (Inputs)**1. Actual amount of professional FTE/SYs expended this Program**

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	1.8
Actual	0.0	0.0	0.0	2.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	60451
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	31803
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	97446

V(D). Planned Program (Activity)**1. Brief description of the Activity**

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. Brief description of the target audience

Food scientists, economists, extension personnel, small farmers and food handlers.

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

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	0	0	0	0
Actual	0	0	0	0

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

Year: 2009

Plan: 0

Actual: 0

Patents listed**3. Publications (Standard General Output Measure)****Number of Peer Reviewed Publications**

2009	Extension	Research	Total
Plan	0	1	
Actual	0	1	1

V(F). State Defined Outputs**Output Target****Output #1****Output Measure**

- Scientific publications relating to the present and future causes and costs of food borne illnesses in Tennessee

Year	Target	Actual
2009	1	1

Output #2**Output Measure**

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

Year	Target	Actual
2009	0	0

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Number of people with increase knowledge of sources, estimated cost, and recommendations concerning foodborne illnesses in Tennessee
2	Number of persons receiving training and education in foodborne illnesses and prevention
3	Number of consumers applying knowledge from education and training
4	Number of small producers applying knowledge from education and training

Outcome #1**1. Outcome Measures**

Number of people with increase knowledge of sources, estimated cost, and recommendations concerning foodborne illnesses in Tennessee

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	50	200

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Food safety has become increasingly important in the U.S. Many people are hospitalized, become ill or die from consuming unsafe food. About 76 million people become ill from consuming unsafe food, 325,000 are hospitalized and 5,000 die each year due to eating unsafe food. NA accurate count of the number of people consuming unsafe food is difficult to estimate. National average have been used to report incidences for many years. There is tremendous cost imposed on society due to food borne illnesses. In spite of this, there is still a need to provide information to consumers on issues related to food safety.

What has been done

A survey to assess food safety issues and training needs of consumers was conducted in collecting information from Tennessee consumers including food service workers.

Three presentations on food safety were made at the Food Distribution Research Society meeting in Broomfield, Colorado; Tuskegee University in Alabama and Tennessee State University in Nashville, TN

Results

Information collected showed that food safety is still of great concern to Tennesseans. About 67% of respondents for the survey were interested in being trained in food safety. A total of 36% of respondent did not think that food service and restaurant workers received adequate training in Tennessee.

4. Associated Knowledge Areas

KA Code	Knowledge Area
504	Home and Commercial Food Service
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #2

1. Outcome Measures

Number of persons receiving training and education in foodborne illnesses and prevention

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	60	100

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

It is important to identify the training need areas for making food safety a realizable goal in Tennessee.

What has been done

A survey was used to collect information on the training needs for food safety.

Results

Information collected showed that food safety is still of great concern to Tennesseans. About 90% of survey participants indicated that they were very concerned while only 3% indicated no concern for food safety. According to respondents, training in the following areas of food safety, food handling, keeping food safe and understanding of food safety needed more attention.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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 #3

1. Outcome Measures

Number of consumers applying knowledge from education and training

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	50	250

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Consumers need information on food safety in order to know the sources of possible illnesses and consequences of consuming unsafe food. The Level of concern for food safety was a good indication of consumers' interest in information in food safety.

What has been done

A survey to assess food safety issues and training needs of consumers was conducted in collecting information from Tennessee consumers including food service workers.

Three presentations on food safety were made at the Food Distribution Research Society meeting in Broomfield, Colorado; Tuskegee University in Alabama and Tennessee State University in Nashville, TN.

Results

The presentation at the professional meetings and posters presented provide much needed information on food safety to consumers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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 #4

1. Outcome Measures

Number of small producers applying knowledge from education and training

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
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2009

25

25

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Small farmers can benefit from food safety information with limited resources to cover themselves in any outbreaks that could inflict significant economic burden, this categories of farmers benefit from food safety information.

What has been done

A survey to assess food safety issues and training needs of consumers was conducted in collecting information from Tennessee consumers including food service workers.

Three presentations on food safety were made at the Food Distribution Research Society meeting in Broomfield, Colorado; Tuskegee University in Alabama and Tennessee State University in Nashville, TN.

Results

The Professional Agricultural Workers Conference (PAWC) targets a diverse audience which include small farmers. Information on sources and costs of food borne illnesses were presented to the audience which included small farmers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

{No Data Entered}

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

1. Evaluation Studies Planned

- Before-After (before and after program)
- During (during program)
- Case Study
- Comparisons between program participants (individuals, group, organizations) and non-participants

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)**Program # 4****1. Name of the Planned Program**

Food Safety: characterization of antibiotic resistant food borne pathogens in fresh produce

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins				100%
	Total				100%

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	2.2
Actual	0.0	0.0	0.0	3.1

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	93700
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	49295
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	151041

V(D). Planned Program (Activity)

1. Brief description of the Activity

Data on the prevalence and types of antibiotic resistant microorganisms isolated from fresh produce will be obtained and may help explicate the role of foods in the transmission of antibiotic-resistant strains to human populations.

2. Brief description of the target audience

Agricultural producers and consumers in Middle Tennessee.

V(E). Planned Program (Outputs)

1. Standard output measures

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	0	0	0	0
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2009

Plan: 0

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2009	Extension	Research	Total
Plan	0	1	
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- 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.

Year	Target	Actual
2009	0	3

Output #2

Output Measure

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

Year	Target	Actual
2009	0	1

Output #3

Output Measure

- Profiles of antibiotic resistance in fresh produce determined.

Year	Target	Actual
2009	1	8

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

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.

Outcome #1

1. Outcome Measures

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

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The emergence of antibiotic resistant bacteria in the food chain has become a major area of concern. Data on patterns and profiles of antibiotic resistance obtained from this study will be essential in implementing measures needed to control the spread of antibiotic-resistant pathogens in fresh produce.

What has been done

One hundred households in Middle Tennessee have been recruited to be educated on fresh produce handling practices.

Results

Consumers have not been educated on fresh produce handling practices. There was a delay in compiling laboratory results and identifying consumer's fresh produce handling practices. Laboratory results are being used in the development of educational materials.

4. Associated Knowledge Areas

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #2

1. Outcome Measures

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

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	20	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Use of antibiotics in agriculture has contributed to the increased prevalence of antibiotic-resistant bacteria in the environment. Antibiotics in farming not only selects for the occurrence of antibiotic-resistant pathogens, but also carry the risk that such strains will become truly multi-resistant and a health risk to the public. Data collected through this study will provide information on the diffusion of antibiotic-resistant bacteria in the farms. The information obtained from this study will also be used to develop and disseminate education materials on agricultural practices; such as judicious use of antibiotics in fresh produce production.

What has been done

Farmers (n= 50) in Middle Tennessee have been recruited to receive educational materials on safe agricultural practices. Using the laboratory result, educational materials are being designed to educate the farmers on avoiding planting crops on land prone to flooding, animal feeding units coming down stream for irrigating farms, testing of irrigation water before application process, and avoiding application of animal manure on the fields within 120 days before harvesting.

Results

Producers have not been educated. It was a challenge to get information on farm management practices from some farmers and therefore, had to recruit other participants. Educational materials on safe agricultural practices are being developed to be disseminated to recruited farmers. After the delivery of educational materials, farmers will be visited to determine if they have improved on agricultural practices.

4. Associated Knowledge Areas

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

{No Data Entered}

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

1. Evaluation Studies Planned

- Before-After (before and after program)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

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

Childhood Obesity: improving limited resource families through improved nutrition and well-being

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				50%
724	Healthy Lifestyle				50%
	Total				100%

V(C). Planned Program (Inputs)**1. Actual amount of professional FTE/SYs expended this Program**

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	3.2
Actual	0.0	0.0	0.0	2.5

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	75566
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	39754
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	121808

V(D). Planned Program (Activity)**1. Brief description of the Activity**

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. Brief description of the target audience

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

V(E). Planned Program (Outputs)

1. Standard output measures

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	0	0	0	0
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2009
 Plan: 0
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2009	Extension	Research	Total
Plan	0	2	
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

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

Year	Target	Actual
2009	2	0

Output #2

Output Measure

- Development of complete set of games for project use

Year	Target	Actual
2009	1	1

Output #3

Output Measure

- Development of healthy mini-camp curricula

Year	Target	Actual
2009	1	1

Output #4

Output Measure

- Development of complete set of online lessons for parents

Year	Target	Actual
2009	0	0

Output #5

Output Measure

- Development of newsletters for families.

Year	Target	Actual
2009	10	2

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

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 Measures

Percentage of participants with increased nutrition knowledge

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	20	50

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Experts believe that limited resource families with children in the household who receive nutrition education and who practice good eating habits at home will more likely establish life-long healthy eating habits for those children.

What has been done

A survey addressing dietary practices and behaviors was conducted with 53 caregivers. Based on their responses, three lessons on healthy eating and parent-child interaction were completed with an average attendance of 30 parents.

Results

A post-lesson knowledge assessment indicated parents were more aware of how to plan nutritious meals for their families and had a better idea of how to apply what they learned to their daily lives.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle

Outcome #2

1. Outcome Measures

Percentage of participants with improved reported behaviors

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	12	10

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Dietary practices are learned at an early age and are shown to have an impact on the health of the child throughout life.

What has been done

A survey of 25 low income parents was completed that assessed the reported foods purchased before and after participation in a nutrition workshop.

Results

An increased percentage indicated they considered the nutritional value of the food when making purchasing decisions. However, price and taste were still the major factors considered. The number of persons who reported purchasing more vegetables increased slightly, whole fruit purchases remained the same.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle

Outcome #3

1. Outcome Measures

Quarterly percent increase in participation points

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Annual percent increase in number of males participating

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	10	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Males generally do not participate in nutrition education, yet they influence food purchases. As such, they have an impact on what their children eat.

What has been done

Three nutrition workshops were conducted for Head Start parents. To accommodate work schedules of the participants, two were held during the day and one was at night.

Results

The percent of male participating in the sessions decreased; perhaps because there were more day sessions than evening sessions.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle

Outcome #5

1. Outcome Measures

Percentage decrease in school absenteeism

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	10	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Children with health and weight problems tend to have a higher absentee rate.

What has been done

Attendance records and weight data were obtained from Head Start very late in the project. However, the data received was flawed and unreliable.

Results

No results to date.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Populations changes (immigration, new cultural groupings, etc.)
- null

Brief Explanation

{No Data Entered}

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

1. Evaluation Studies Planned

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

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)**Program # 6****1. Name of the Planned Program**

Climate Change: assessment of nutrients in the Collins River basin

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 (Inputs)**1. Actual amount of professional FTE/SYs expended this Program**

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	3.0
Actual	0.0	0.0	0.0	2.7

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	81609
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	42934
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	131552

V(D). Planned Program (Activity)**1. Brief description of the Activity**

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. Brief description of the target audience

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

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

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	0	0	0	0
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2009
 Plan: 0
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2009	Extension	Research	Total
Plan	0	0	
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

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

Year	Target	Actual
2009	0	1

Output #2

Output Measure

- Development of water quality analysis techniques

Year	Target	Actual
2009	0	0

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

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 Measures**

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

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	10	7

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Nursery crop growers are not aware of the impact of their fertilizer and lime management practices on surface water. As a result of this issue, water managers and residents that live in the Collins River watershed and the State regulatory agency (Tennessee Department of Environment & Conservation, TDEC) care because of the possible effects of nursery crop production on the water quality of inflows (tributaries) to the Collins River.

What has been done

Three major tributaries (Mountain creek, Charles creek, Hills creek) of the Collins River were sampled in the fall of 2008 and spring of 2009 during ten consecutive weeks for Nitrate-N, Ortho-Phosphorus, Calcium, Magnesium, Potassium and Sodium. The following water quality parameters: pH, Temperature, Dissolved oxygen, Turbidity, Specific conductance and Total dissolved solids were also monitored.

Results

The average nitrate concentrations in the creeks were low both in fall of 2008 and spring of 2009. Mountain creek in fall of 2008 (0.67-1.11 mg/L of nitrate); in spring of 2009 (0.48-1.62 mg/L of nitrate); Charles creek in fall of 2008 (0.83-0.98 mg/L of nitrate); in spring of 2009 (0.88-1.49 mg/L of nitrate); Hills creek in fall of 2008 (0.09-0.23 mg/L of nitrate); in spring of 2009 (0.43-1.10 mg/L of nitrate); Phosphorus in both fall of 2008 and spring of 2009 ranged from 0.02 mg/L in Mountain creek and Hills creek to 0.27 mg/L in Charles creek. Additionally, all the creeks at the time of sampling had relatively low concentrations of cations except calcium. Sodium concentration is not being reported because it was below detection limits during the monitoring period(s). In fall of 2008, Mountain creek had K concentration ranging from 1.62-3.25 mg/L; Mg concentration ranging from 5.75-7.07 mg/L and 32.39-41.55 mg/L of Ca; Charles creek 0.72-1.00 mg/L of K; 8.58-9.30 mg/L of Mg and 38.54-45.78 mg/L of Ca; Hills creek 1.92-3.00 mg/L of K; 21.96-41.74 mg/L of Mg and 63.9-90.33 mg/L of Ca). In spring of 2009, Mountain creek had K concentration ranging from 0.08-1.11 mg/L; Mg concentration ranging from 17.23-39.98 mg/L and 10.85-28.25 mg/L of Ca; Charles creek 0.09-0.52 mg/L of K; 30.23-68.10 mg/L of Mg and 14.62-33.66 mg/L of Ca; Hills creek 0.08-2.50 mg/L of K; 24.18-82.43 mg/L of Mg and 19.20-64.25 mg/L of Ca). Considering the hydro-geologic conditions of Middle Tennessee, with abundance of limestone rocks, it was expected that calcium and magnesium will be relatively high. Water quality parameters data during base flow were as follows in fall of 2008: Mountain creek (Average pH value = 7.64, water temperature = 9.550C, dissolved oxygen 7.82 mg/L, turbidity = 4.02 NTU, Specific conductance = 255.33µs and total dissolved solids = 125gram/L). Charles creek (Average pH value = 7.77, water temperature = 10.750C, dissolved oxygen 9.95 mg/L, turbidity = 2.85 NTU, Specific conductance = 254µs and total dissolved solids = 150.66 gram/L). Hills creek (Average pH value = 6.7, water temperature = 11.280C, dissolved oxygen 7.65 mg/L, turbidity = 6.57 NTU, Specific conductance = 680µs

and total dissolved solids = 333 gram/L).

Water quality parameters data during base flow were as follows in spring of 2009: Mountain creek (Average pH value = 7.61, water temperature = 15.250C, dissolved oxygen 6.88 mg/L, turbidity = 3.35 NTU, Specific conductance = 190.27µs and total dissolved solids = 95gram/L). Charles creek (Average pH value = 7.56, water temperature = 16.110C, dissolved oxygen 9.34 mg/L, turbidity = 2.55 NTU, Specific conductance = 214µs and total dissolved solids = 120.27 gram/L). Hills creek (Average pH value = 6.6, water temperature = 15.280C, dissolved oxygen 8.85 mg/L, turbidity = 12.61 NTU, Specific conductance = 279µs and total dissolved solids = 143 gram/L).

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management

Outcome #2

1. Outcome Measures

Number of water bodies removed from 303(d) list

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Collins River is listed in the State's 303(d) list of impaired water body. As a result, the state regulatory agency (TDEC) is concerned about this river. In the long run, TDEC would like to see Collins River removed from the 303(d) list.

What has been done

Major inflow creeks of the Collins River are being monitored during 2008 and 2009 for for nutrients and water quality parameters.

Results

It is too soon to conclude that the in-flow creeks monitored (Mountain creek, Charles creek, Hills creek) do not contribute to the impairment of the water quality of the Collins River. More sampling seasons are needed to ascertain why Collins River is on the 303(d) list.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management

Outcome #3**1. Outcome Measures**

Number of agricultural producers per year developing a nutrient management plan

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	2	7

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

The Collins River is a major source of public water supply and recreational source for the residents of the Collins River watershed. The Collins River watershed drains four (4) rural counties in Middle Tennessee. As a result of this issue, water managers and residents that live in the watershed and the State regulatory agency (Tennessee Department of Environment & Conservation, TDEC) care because of the possible effects of nursery crop production on the water quality of inflows (tributaries) to the Collins River.

What has been done

Major inflow creeks of the Collins River were monitored for major fertilizer nutrient(s) in fall of 2008 and spring 2009.

Results of the monitoring exercise were shared with growers at the 2009 Southern Nursery Association (SNA) trade show and conference in Atlanta GA. Some of the growers had their field nursery crop operation(s) at the Collins River sub-watershed. The forum was used to introduce the concept of developing nutrient management plan for their field operation.

Results

The growers (seven) were aware of the impact of nutrient enrichment on the water quality of the creeks. We reiterate the adoption of nutrient management strategies for individual nursery fields; as this concept could be an effective component for improved watershed nutrient management that will enhance water quality and Total Maximum Daily Loads (TMDL) goals.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management

Outcome #4

1. Outcome Measures

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

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	1	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

There is the need to train future workforce (students) to meet the need of water resource issues, especially in the area of water quality assessment and monitoring.

What has been done

Two students hired as student work aides are involved in the project and gaining both research and extension experiential training.

Results

The students are assisting in instrument calibration and stream water sampling.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

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

1. Evaluation Studies Planned

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

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)**Program # 7****1. Name of the Planned Program**

Global Food Security and Hunger: evaluation of pathogen infectivity in stressed plants.

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

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants				30%
212	Pathogens and Nematodes Affecting Plants				50%
216	Integrated Pest Management Systems				20%
	Total				100%

V(C). Planned Program (Inputs)**1. Actual amount of professional FTE/SYs expended this Program**

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	2.2
Actual	0.0	0.0	0.0	2.5

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	75564
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	39754
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	121808

V(D). Planned Program (Activity)**1. Brief description of the Activity**

Research in the molecular response of plants to stress and subsequent pathogen establishment.
Development of techniques to mitigate the exploitation of plant stress proteins by plants.
Strategize implications of of host stress in pest management practices.

2. Brief description of the target audience

Plant pest management researchers and agricultural producers.

V(E). Planned Program (Outputs)

1. Standard output measures

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	0	0	0	0
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2009

Plan: 0

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2009	Extension	Research	Total
Plan	0	1	
Actual	0	1	1

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

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

Year	Target	Actual
2009	2	2

Output #2

Output Measure

- Scientific publications concerning pathogen infectivity in stress induced plants

Year	Target	Actual
2009	0	1

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

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

Outcome #1**1. Outcome Measures**

Number of integrated stress management and disease prevention strategies developed

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	1	1

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Potato (*Solanum* spp.) the target species of this research is the fourth most important food crop in the world. As such, any improvements in the the ability to reduce yield losses in a sustainable manner are important for potato and other crops. The integrated pest management strategies being examined in this project are contributory to sustainable agriculture.

What has been done

Infectivity analyses experiments have been conducted using two soft-rot mutants (high and low virulence), two plant types (heat resistant and sensitive) in the minimum three kinds of temperature treatments. Thus these eighteen different combinations have been compared to study the infectivity on stressed and non-stressed hosts in culture, in greenhouse and as tuber.

Results

On the basis of these experiments it is concluded that nexus between stress and proportional vulnerability to infections exists when potatoes were used as host in culture, in greenhouse and as tubers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems

Outcome #2**1. Outcome Measures**

Number of molecular mechanisms for plant stress identified

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	2	2

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Knowledge of the nexus between stress and infectivity would be of great benefit in the development of stress resistant plants. The identification of these components at a molecular level will lead to a better understanding to the processes and speed the identification of plants with superior abilities to resist pests.

What has been done

Two different potatoes were used as hosts in culture, in greenhouse and as tubers for the infectivity experiments. These were Atlantic (heat sensitive) and Norchip (heat resistant) potato varieties. Six different temperature regimes (42C at 2, 4, 6, 16 and 24 hrs) were used to compare the sensitivity to infection under stress of the two kinds of hosts.

Results

Using potatoes in culture, in greenhouse and as tubers it was evident that short duration stress "prepares" host for subsequent soft-rot infection. On other hand increasingly longer stress treatment of the hosts successively increased the level of infections. However, 'Atlantic' and 'Norchip' that differ in production-kinetics of low molecular weight HSPs also showed varied response to stress-infection treatments. As expected, Atlantic potatoes were overall more sensitive to combined soft-rot and temperature-stress treatment compared to Norchip potatoes.

4. Associated Knowledge Areas

KA Code	Knowledge Area
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems

Outcome #3**1. Outcome Measures**

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

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	1	1

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

According to the Tennessee State University master plan, one of the long range goals of the university is the development of excellence in agriculture and provide training to minority students in the advanced field of plant biotechnology.

What has been done

This project has contributed in of training undergraduate and graduate students in microbial and plant molecular biology techniques.

Results

This project has contributed in of training one graduate student in microbial and plant molecular biology techniques which while exposing at-least one undergraduate and several pre-college students to these technologies.

4. Associated Knowledge Areas

KA Code	Knowledge Area
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems

Outcome #4**1. Outcome Measures**

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

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	30	100

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Completion of the project will aid in the development of integrated pest management strategies and disease resistant plants. Thus the stakeholders who adopt and use these methods would benefit the production of potato and other crops

What has been done

Research findings have been presented at various forums including 93rd Annual Meeting of The Potato Association of America at Fredericton, NB, Canada held in August 9-13, 2009. The title of presentations was, "In Vitro and In Vivo responses of Atlantic and Norchip Potatoes to Simultaneous Exposure to Various Heat Stress Regimes and Erwinia carotovora Mutants. Research paper titled "Effects of Temperature Stress on Solanum Host for the Spread of Soft-Rot Infection was also submitted for Southern Nursery Association Research Conference Proceedings.

Results

More than 100 stakeholders have been exposed to research results at 93rd Annual Meeting of The Potato Association of America at Fredericton, NB, Canada held in August 9-13, 2009. At this meeting and other forums the target audience included scientists from various discipline (including USDA) and producers. In addition, manuscript and research proposal based on current research findings are also under preparation.

4. Associated Knowledge Areas

KA Code	Knowledge Area
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

{No Data Entered}

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

1. Evaluation Studies Planned

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

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)**Program # 8****1. Name of the Planned Program**

Global Food Security and Hunger: strategies to improve meat goat and guinea fowl production

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
302	Nutrient Utilization in Animals				20%
303	Genetic Improvement of Animals				20%
304	Animal Genome				60%
	Total				100%

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	4.3
Actual	0.0	0.0	0.0	3.2

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	96722
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	50884
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	155914

V(D). Planned Program (Activity)

1. Brief description of the Activity

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.

2. Brief description of the target audience

Meat goat industry, poultry industry, small farmers, scientific community, and extension specialists.

V(E). Planned Program (Outputs)

1. Standard output measures

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	0	0	0	0
Actual	0	0	0	0

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

Year: 2009

Plan: 0

Actual: 0

Patents listed**3. Publications (Standard General Output Measure)****Number of Peer Reviewed Publications**

2009	Extension	Research	Total
Plan	0	4	
Actual	0	3	3

V(F). State Defined Outputs**Output Target****Output #1****Output Measure**

- Evaluation of livestock management techniques for economic feasibility

Year	Target	Actual
2009	1	1

Output #2**Output Measure**

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

Year	Target	Actual
2009	2	1

Output #3**Output Measure**

- Construction of cDNA library for Guinea fowl

Year	Target	Actual
------	--------	--------

2009

1

1

Output #4

Output Measure

- Scientific publications relating to management strategies to improve meat goat and guinea fowl production

Year

Target

Actual

2009

4

3

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Number of adipose-specific genes identified
2	Percentage of overall reduction in fat deposition
3	Number of birds examined in genetic resource population
4	Number of meat goats screened for genetic markers

Outcome #1

1. Outcome Measures

Number of adipose-specific genes identified

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	25	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Identification of adipose specific genes /loci will facilitate selection of leaner birds.

What has been done

cDNA libraries of the hypothalamus, liver, and pancreas of the Guinea fowl were constructed and screened.

Results

Genes that may be responsible for excessive fat deposition were identified.

4. Associated Knowledge Areas

KA Code	Knowledge Area
303	Genetic Improvement of Animals
304	Animal Genome

Outcome #2

1. Outcome Measures

Percentage of overall reduction in fat deposition

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Excessive fat deposition in poultry is a liability to the consumer and producer.

What has been done

Two pureline populations of chicken divergent in fat deposition have been established These purelines will be used to generate the reference population.

Results

This research is n progress, results will not be realized until the populations analysis is complete and new lines are established, according to research plan.

4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals

Outcome #3

1. Outcome Measures

Number of birds examined in genetic resource population

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	200	95

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Excessive fat deposition is liability to the poultry industry.

What has been done

Pureline populations were evaluated for body weight gain and fat deposition. These populations were also evaluated for copy number variation.

Results

Ninety-six copy number variations were identified which include genes that code for traits of economic importance in poultry, such as fatness.

4. Associated Knowledge Areas

KA Code	Knowledge Area
304	Animal Genome

Outcome #4**1. Outcome Measures**

Number of meat goats screened for genetic markers

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	40	0

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Goat producers in the Southeast United States are facing animal fitness problems. Better breeding stock suited to the environment would help alleviate some of these problems.

What has been done

500 herd contemporaries with phenotypic fitness records have been sampled for genetic screening.

Results

Significant phenotypic differences among herd sub-populations have been demonstrated. Marker screening is being performed.

4. Associated Knowledge Areas

KA Code	Knowledge Area
303	Genetic Improvement of Animals
304	Animal Genome

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Appropriations changes

Brief Explanation

{No Data Entered}

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

1. Evaluation Studies Planned

- After Only (post program)
- Retrospective (post program)
- During (during program)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)**Program # 9****1. Name of the Planned Program**

Global Fod Security and Hunger: strategies to improve growth and performance of guinea fowl

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

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
302	Nutrient Utilization in Animals				50%
307	Animal Management Systems				50%
	Total				100%

V(C). Planned Program (Inputs)**1. Actual amount of professional FTE/SYs expended this Program**

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	3.6
Actual	0.0	0.0	0.0	2.8

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	84632
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	44524
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	136424

V(D). Planned Program (Activity)**1. Brief description of the Activity**

To enhance performance and adoption of guinea fowl as alternative livestock for small scale farmers the following activities will be carried out:

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.

2. Brief description of the target audience

Guinea fowl and poultry industries, small farmers, scientific community, extension specialists.

V(E). Planned Program (Outputs)

1. Standard output measures

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	0	0	0	0
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2009

Plan: 0

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2009	Extension	Research	Total
Plan	0	2	
Actual	0	1	1

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Scientific publications concerning the optimization of parameters for guinea fowl production

Year	Target	Actual
2009	2	1

Output #2

Output Measure

- Dietary recommendations to guinea fowl producers for optimal production

Year	Target	Actual
2009	1	1

Output #3

Output Measure

- Technique to determine optimal nutrient composition of guinea fowl diet

Year	Target	Actual
2009	1	1

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Dietary recommendations for amino acid and mineral nutrition of guinea fowl
2	Percentage of producers realizing savings in feeding costs
3	Percentage of producers aware of recommendations for floor space, calcium and phosphorus
4	Percentage of producers implementing recommendations
5	Percentage of producers realizing profitability after adoption of recommendations

Outcome #1

1. Outcome Measures

Dietary recommendations for amino acid and mineral nutrition of guinea fowl

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	1	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

There are currently no guidelines for optimum amino acid and mineral nutrition requirements for Guinea fowl. As commercial production of this species increases, such requirements must be known to optimize producer efficiency.

What has been done

Ongoing experiments in optimizing amino acid and mineral nutrition levels.

Results

Dietary recommendation of calcium and phosphorus for Pearl Gray guinea fowl layers has been determined and communicated to the Guinea fowl production community.

4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
307	Animal Management Systems

Outcome #2

1. Outcome Measures

Percentage of producers realizing savings in feeding costs

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The costs associated with the production of Guinea fowl need to be minimized for producers to realize maximum profit as this species becomes more accepted in American diets.

What has been done

Requirements for calcium and phosphorus for the Pearl Gray guinea fowl layer were determined and communicated to stakeholders via scientific, popular, and grower target publications and presentations.

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems

Outcome #3

1. Outcome Measures

Percentage of producers aware of recommendations for floor space, calcium and phosphorus

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	90	50

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Optimum floor space utilization can minimize production costs and increase profitability of Guinea fowl production.

What has been done

Optimum floor space requirement for Guinea fowl (French) and the Pearl Gray guinea fowl was determined and the findings will be presented to the Guinea Fowl Breeders Association and poultry producers at scientific forums.

Results

Producers can now increase the efficiency of their operations. Percentage of producers reached was less than planned due to limited attendance at appropriate meetings.

4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
307	Animal Management Systems

Outcome #4

1. Outcome Measures

Percentage of producers implementing recommendations

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	80	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Implementation of recommendations of optimum floor space and calcium and phosphorus requirements will decrease the cost of production of guinea fowl.

What has been done

Floor space, calcium, and phosphorus requirements have been determined and communicated to producers.

Results

Assessment of adoption of recommendations has not been completed yet.

4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
307	Animal Management Systems

Outcome #5

1. Outcome Measures

Percentage of producers realizing profitability after adoption of recommendations

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	80	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Adoption of recommended floor space, calcium, and phosphorus requirements can increase profitability of Guinea fowl production.

What has been done

Optimal floor space, calcium and phosphorus requirements have been determined and communicated to producers.

Results

Assessment of profitability has not been completed yet.

4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
307	Animal Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

{No Data Entered}

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

1. Evaluation Studies Planned

- After Only (post program)
- During (during program)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)**Program # 10****1. Name of the Planned Program**

Global Food Security and Hunger: doe reproductive output, fitness and longevity in meat goat breeds

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

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
301	Reproductive Performance of Animals				70%
307	Animal Management Systems				30%
	Total				100%

V(C). Planned Program (Inputs)**1. Actual amount of professional FTE/SYs expended this Program**

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	2.5
Actual	0.0	0.0	0.0	4.4

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	132993
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	69967
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	214381

V(D). Planned Program (Activity)**1. Brief description of the Activity**

Conduct meat goat experiments on longitudinal doe performance, conduct producer workshops on assessing does for fitness and reproductive output.

2. Brief description of the target audience

Southeastern meat goat producers.

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

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	0	0	0	0
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2009
 Plan: 0
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2009	Extension	Research	Total
Plan	0	0	
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

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

Year	Target	Actual
2009	0	0

Output #2

Output Measure

- Publications to inform producers and researchers of the effects of breed and age on lifetime productivity and longevity of meat goat does managed under Southeastern pastures

Year	Target	Actual
2009	1	3

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Percentage of Tennessee meat goat producers participating in doe record keeping
2	Average increase per herd of doe retention rate

Outcome #1**1. Outcome Measures**

Percentage of Tennessee meat goat producers participating in doe record keeping

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	20	0

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

With increasing input costs, producers are seeking ways to improve profit margins by identifying breeding stock that perform efficiently with limited inputs.

What has been done

A system of on farm performance testing has been designed for meat goat producers to objectively assess doe performance based on reproductive output.

Results

Across the commercial meat goat industry, on farm testing of doe herd performance has increased as more breeders are using performance data to make selection decisions and for marketing of replacement breeding stock. It is currently too early for assessment of the percentage of producers participating in doe record keeping.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
307	Animal Management Systems

Outcome #2**1. Outcome Measures**

Average increase per herd of doe retention rate

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Replacing mature herd does with young developing females can represent an economic and biological liability to producers due to limited production in young does coupled with significant resource requirements with no guarantee of immediate return on the inputs used to develop replacement does.

What has been done

A meat goat breeding herd with diverse genetic lines has been established with different lines demonstrating significantly levels of doe fitness and annual herd retention.

Results

Producers have been informed of the differences among genetic lines for doe fitness and annual retention under commercial management conditions and that genetic selection is key to doe retention so that expensive doe replacement can be minimized for overall herd management.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
307	Animal Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Appropriations changes
- null

Brief Explanation

{No Data Entered}

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

1. Evaluation Studies Planned

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

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)**Program # 11****1. Name of the Planned Program**

Global Food Security and Hunger: molecular approaches for the study of leaf surface microorganisms

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 (Inputs)**1. Actual amount of professional FTE/SYs expended this Program**

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	1.8
Actual	0.0	0.0	0.0	2.6

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	78587
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	41344
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	126680

V(D). Planned Program (Activity)**1. Brief description of the Activity**

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*. Make comparisons between epiphytic microbial populations in diseased and healthy plants. Make comparisons between epiphytic microbial populations on different hosts. Make comparisons between epiphytic microbial populations in plants grown under different conditions. 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. Brief description of the target 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(E). Planned Program (Outputs)

1. Standard output measures

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	0	0	0	0
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2009

Plan: 0

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2009	Extension	Research	Total
Plan	0	2	
Actual	0	1	1

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Scientific publications relating to plant/leaf microbe interactions

Year	Target	Actual
2009	2	1

Output #2

Output Measure

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

Year	Target	Actual
2009	1	2

Output #3

Output Measure

- Number of pertinent bacterial strains identified

Year	Target	Actual
2009	2	5

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Number of host/Pseudomonas pathosystems elucidated
2	Number of potential biocontrol candidates identified
3	Number of crops with blocked epiphyte-pathogen switch identified

Outcome #1**1. Outcome Measures**

Number of host/Pseudomonas pathosystems elucidated

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	0	1

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Plant diseases caused by Pseudomonas species result in high crop losses and cost of disease control. A good understanding of these diseases could reduce these losses.

What has been done

An experiment was performed to find a suitable experimental host to study Pseudomonas diseases in ornamental crop using two cultivars of Geranium (Maverick Pink and Horizon Orange) and eight strains of Pseudomonas syringae pathovars. Epiphytic bacteria were isolated from wild and cultivated geraniums and characterized. These make candidate biocontrol agents.

Results

There were significant differences among the cultivars, bacterial strains and interactions of both. Two strains were good for host pathogen studies. The epiphytic bacteria make good candidates for biocontrol of Pseudomonas diseases.

4. Associated Knowledge Areas

KA Code	Knowledge Area
212	Pathogens and Nematodes Affecting Plants

Outcome #2**1. Outcome Measures**

Number of potential biocontrol candidates identified

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	1	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Pseudomonas species cause many plant diseases resulting in huge losses yield and income.

What has been done

Many bacteria were isolated from leaf surfaces of geranium}

Results

The bacterial were purified and partially characterized. These make good candidates for biocontrol of Pseudomonas diseases.

4. Associated Knowledge Areas

KA Code	Knowledge Area
212	Pathogens and Nematodes Affecting Plants

Outcome #3

1. Outcome Measures

Number of crops with blocked epiphyte-pathogen switch identified

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

{No Data Entered}

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

1. Evaluation Studies Planned

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

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)**Program # 12****1. Name of the Planned Program**

Global Food Security and Hunger: functional studies on cold and heat-regulated genes

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				100%
	Total				100%

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	2.1
Actual	0.0	0.0	0.0	2.4

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	72542
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	38164
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	116935

V(D). Planned Program (Activity)

1. Brief description of the Activity

Conduct gene expression research experiments, provide training for graduate students, develop products and services.

2. Brief description of the target audience

Plant breeders, seed companies, scientific colleagues, extension service.

V(E). Planned Program (Outputs)

1. Standard output measures

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	0	0	0	0
Actual	0	0	0	0

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

Year: 2009

Plan: 0

Actual: 0

Patents listed**3. Publications (Standard General Output Measure)****Number of Peer Reviewed Publications**

2009	Extension	Research	Total
Plan	0	1	
Actual	0	3	3

V(F). State Defined Outputs**Output Target****Output #1****Output Measure**

- Scientific publications pertaining to expression of temperature stress genes in plants

Year	Target	Actual
2009	1	3

Output #2**Output Measure**

- Patents for temperature stress genes

Year	Target	Actual
2009	0	0

Output #3**Output Measure**

- Temperature stress tolerant plant cultivars

Year	Target	Actual
2009	0	0

Output #4

Output Measure

- Techniques to quantify heat and chilling stress tolerance in plants

Year	Target	Actual
2009	0	0

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Temperature stress tolerance genes identified
2	Temperature stress tolerant plant cultivars developed

Outcome #1

1. Outcome Measures

Temperature stress tolerance genes identified

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	1	10

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Both the scientific community and plant breeders want information concerning the genes that are associated with temperature stress. Improved tolerance to temperature stress will greatly enhance crop yields.

What has been done

The sequence for freeze tolerance genes have been isolated and cloned from cold hardy plant species (Helloboreus).

Results

10 putative cold-hardiness genes have been isolated and submitted to appropriate databases. The technical procedure for transformation of tomato and evaluation of transgenic plants have been developed and presented at professional meetings. One graduate student has been trained in tomato transformation techniques.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms

Outcome #2

1. Outcome Measures

Temperature stress tolerant plant cultivars developed

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The availability of temperature stress tolerant cultivars is critical to ensure crop production in years with abnormal temperatures, and expand the regions in which the plants can be successfully grown. This is important for growers, breeders, and consumers.

What has been done

Homozygous transgenic lines have been selected and evaluation for their tolerance to stresses is underway.

Results

No results to report until appropriate plants are evaluated.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

{No Data Entered}

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

1. Evaluation Studies Planned

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

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)**Program # 13****1. Name of the Planned Program**

Global Food Security and Hunger: Biopesticides to control disease & insect and improve water quality

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				20%
215	Biological Control of Pests Affecting Plants				80%
	Total				100%

V(C). Planned Program (Inputs)**1. Actual amount of professional FTE/SYs expended this Program**

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	3.5
Actual	0.0	0.0	0.0	3.2

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	96722
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	50885
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	155914

V(D). Planned Program (Activity)**1. Brief description of the Activity**

The research proposed under this project will identify multiple new biopesticide compounds that can manage soil borne pathogen and insect problems in container nurseries. 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. Brief description of the target 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.

V(E). Planned Program (Outputs)

1. Standard output measures

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	0	0	0	0
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2009

Plan: 0

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2009	Extension	Research	Total
Plan	0	1	
Actual	0	2	2

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Scientific publications documenting the efficacy of biopesticides in container nursery crops

Year	Target	Actual
2009	2	2

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	New regulatory treatments in container nurseries using biopesticide/biorational insect and pathogen treatments to avoid adverse environmental impacts of off site movement of conventional pesticides.
2	Increase in number of producers aware and educated about the problem
3	Number of new biopesticide treatments developed
4	Percent reduction in pesticide movement offsite of research facility

Outcome #1**1. Outcome Measures**

New regulatory treatments in container nurseries using biopesticide/biorational insect and pathogen treatments to avoid adverse environmental impacts of off site movement of conventional pesticides.

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	1	0

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Pesticide and nutrient movement offsite from nurseries is a concern for both regulatory agencies and the general public. Pesticides and nutrients can have adverse effects on aquatic systems and water supply sources for human usage. Biopesticides with shorter residuals and lower acute toxicity may offer advantages in the prevention of non point source pollution from nurseries, while still offering the opportunity to control problematic pests and pathogens.

What has been done

Multiple biopesticides were evaluated as container drenches to control third instar Japanese beetle larvae artificially infested into the potting soil. Potting soil samples were also evaluated against imported fire ants using laboratory bioassays. Biopesticides were also tested as trunk sprays on containerized magnolia trees for prevention of ambrosia beetle attacks.

Results

Biopesticides tested in these studies have not been effective at eliminating Japanese beetle larvae from containers and had no effect on imported fire ants. Biopesticide rates that did reduce grub numbers were either cost prohibitive or caused phytotoxicity on nursery plants. Therefore, the biopesticides we evaluated most likely do not have potential as stand alone regulatory treatments. Consequently, current studies are evaluating low rate biopesticide treatments in combination with reduced rates of conventional pesticides to determine potential synergism and the ability to lower conventional pesticide rates. Like Japanese beetle and fire ant tests, biopesticides we evaluated were not as effective as conventional pesticides for preventing ambrosia beetles.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
215	Biological Control of Pests Affecting Plants

Outcome #2**1. Outcome Measures**

Increase in number of producers aware and educated about the problem

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	150	360

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Pesticide and nutrient movement from nurseries may bring increased regulatory action against nursery producers, which could result in fines and impacts on their profitability. Therefore, it is important to provide educational training regarding water quality management and proper pest and pathogen control techniques to ensure pesticides and nutrients are applied properly to container nurseries to minimize environmental impact. In addition, increased educational awareness to producers regarding the benefits and efficacy of biopesticide substitutions for conventional pesticides may provide further benefit by minimizing the potential regulatory consequences to nursery stakeholders.

What has been done

Educational presentations and research updates were made to nursery growers, extension agents, and nursery stakeholder groups on biopesticide and conventional pesticide issues with managing Japanese beetle, borers, and imported fire ants. Presentations included the Middle Tennessee Nursery Association Monthly Meeting (about 50 growers), the Southern Nursery Association Research Conference (about 40 scientists and unknown numbers of growers), the Tennessee Nursery & Landscape Association Winter Educational Workshop (about 50 growers), and the Tennessee Green Industry Field Day (about 220 growers).

Results

Educational training to nursery producers and extension personnel provided the latest information on best management practices for borers, grubs, and fire ants, as well as methods to reduce grower costs and mitigate offsite chemical movement. Growers benefit from improved knowledge, enhanced production, lower costs, and prevention of environmental degradation that could trigger regulatory interventions and higher costs.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
215	Biological Control of Pests Affecting Plants

Outcome #3**1. Outcome Measures**

Number of new biopesticide treatments developed

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	1	1

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

The nursery and greenhouse industries are important sectors of U.S. Agriculture providing about 2 million jobs according to recent economic estimates. Biopesticides offer an environmentally friendly and worker friendly alternative to conventional pesticides for the treatment of pests and pathogens in containerized nurseries. According to the U.S. Environmental Protection Agency, biopesticides have multiple advantages over conventional pesticides, including: 1) inherently less toxic, 2) often affect only the target pest, 3) often effective in small quantities, 4) decompose quickly, and 5) can reduce reliance on conventional insecticides. In addition, many biopesticides are exempt from pesticide registration requirements, which can reduce the development cost to chemical manufacturers and potentially lower the costs to nursery stakeholders.

What has been done

Multiple biopesticides were tested as container treatments to control third instar Japanese beetle, including EcoTrol EC (rosemary oil [10%] and peppermint oil [2%]), Azatin XL (azadirachtin [3%]), Armorex (rosemary oil [1%], garlic oil [2%], clove oil [2%], white pepper [0.5%], and sesame oil [84.5%]), Cinnacure (cinnamaldehyde [30%]), Triact 70 (clarified hydrophobic extract of neem oil [70%]), SucraShield (sucrose octanoate esters [40%]), and SorbiShield (sorbitol octanoate [90%]). Cinnacure and EcoTrol were also evaluated as trunk sprays to protect containerized trees from ambrosia beetles.

Results

None of the biopesticides provided effective Japanese beetle grub or ambrosia beetle control. Cinnacure was the most effective treatment against fire ants and ambrosia beetles. In the case of ambrosia beetles, permethrin provided greater control efficacy than cinnacure. Based on these results, biopesticide treatments for insect management are now being performed in conjunction with reduced rates of conventional pesticides.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
215	Biological Control of Pests Affecting Plants

Outcome #4**1. Outcome Measures**

Percent reduction in pesticide movement offsite of research facility

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	0	0

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Offsite movement of pesticides from nurseries is a major issue for regulatory agencies. Movement of pesticides into surrounding water systems has numerous potential impacts on both human health and natural systems. Consequently, as regulatory actions increase on nurseries, it could have adverse impacts on the continued operation of nursery businesses. Biopesticides have the potential to mitigate or reduce offsite pesticide movement because many degrade faster and have lower acute toxicity to non-target organisms.

What has been done

Based on the results of our biopesticide testing, it is felt current biopesticides and rates evaluated are not effectively managing target insect pests. Therefore, these biopesticides are not likely to be effective as stand-alone treatments, and will probably need to be used in combination with reduced rates of conventional pesticides. If conventional pesticide rates can be reduced in combination with biopesticides, then offsite pesticide movement will still be reduced. The level of reduction in offsite pesticide movement will depend on rates of biopesticides + conventional pesticides required to eliminate target insect pests.

Results

No results to report because biopesticide treatments have not been effective at managing pests at this time.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation

V(H). Planned Program (External Factors)**External factors which affected outcomes**

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

Brief Explanation

{No Data Entered}

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

1. Evaluation Studies Planned

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

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)**Program # 14****1. Name of the Planned Program**

Global Food Security and Hunger: management of quarantine insects in field nursery production

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
211	Insects, Mites, and Other Arthropods Affecting Plants				100%
	Total				100%

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	4.0
Actual	0.0	0.0	0.0	3.6

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	108813
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	57245
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	175403

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research experiments will be conducted with labeled and experimental insecticide compounds that will lead to new or improved fire ant and Japanese beetle quarantine treatments for field nursery plants. The research will be used to 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.

2. Brief description of the target audience

Nursery producers and policy makers (i.e., regulatory entities involved with decision making on quarantine treatment approval). Pesticide and chemical manufacturers.

V(E). Planned Program (Outputs)

1. Standard output measures

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	0	0	0	0
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2009

Plan: 0

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2009	Extension	Research	Total
Plan	0	1	
Actual	0	1	1

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Refereed publications pertaining to research findings

Year	Target	Actual
2009	1	1

Output #2

Output Measure

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

Year	Target	Actual
2009	1	2

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Numerical increase in grower awareness via educational talks
2	Number of educational trade articles to increase grower awareness
3	Number of refereed manuscripts produced
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	Insecticide label changes based on research

Outcome #1**1. Outcome Measures**

Numerical increase in grower awareness via educational talks

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	100	400

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Imported fire ant and Japanese beetle quarantines impact nursery grower stakeholders by imposing quarantine treatments on their plant shipping activities. Ineffective quarantine treatments can lead to the unintentional movement of these pests into new areas where they cause further multiple negative impacts, including damage to horticultural crops and turf (Japanese beetle) or damage to electrical systems, roads, harvesting equipment, wildlife populations, livestock health, and human health (imported fire ants).

What has been done

Educational presentations providing research updates and proper management techniques for imported fire ants, Japanese beetle, and borers were given to an estimated 415 nursery growers, agricultural extension agents, and a nursery stakeholder advisory panel. Presentations included the Tennessee State University (TSU) Ornamental and Turfgrass Pest Management Extension Workshop (about 70 growers, landscapers, and extension personnel), Southern Nursery Association Research Conference (~ 40 research / extension attendees and an unknown number of growers), Tennessee Green Industry Field Day and Tradeshow (220+ nursery growers attended slide presentation / 100+ growers attended field demonstrations on proper drenching protocols for fire ant treatments and bait spreader calibration), Tennessee Association of Agricultural Agents and Specialists (19 University of Tennessee and TSU extension agents received research information), Middle Tennessee Nursery Association Monthly Meeting (~ 50 nursery growers), and Tennessee Nursery and Landscape Association Winter Educational Workshop (~ 50 nursery growers, landscapers, and extension agents).

Results

University extension personnel, nursery growers, landscapers, turf producers, and other research scientists received updates on the latest research to manage imported fire ants, Japanese beetle, and borers. Field demonstrations were performed at the Tennessee Green Industry Field Day in cooperation with the Tennessee Department of Agriculture (TDA). The demonstrations were given to about 100+ growers along with extension literature on how to properly drench treat post-harvest balled and burlap and containerized nursery stock and growers were shown how to operate and calibrate a Herd spreader for fire ant bait application. Growers were required to watch the demonstration in order to receive certification from TDA, and therefore, this training was essential for growers to be able to continue selling nursery plants. Written and oral information provided to growers and extension agents will improve safety in pesticide handling, provide better quarantine management of fire ants and Japanese beetle thereby reducing unintentional movement of these pests outside of quarantined areas, and improve the productivity and decision-making in nursery businesses.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants

Outcome #2

1. Outcome Measures

Number of educational trade articles to increase grower awareness

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	0	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Imported fire ants and Japanese beetles can cause significant economic impacts when introduced into new areas, as well as imposing time consuming and expensive quarantine regulations on nursery growers.

What has been done

A new extension publication was developed for field-grown nursery growers describing how to use baits to satisfy nursery quarantine certification. In addition, an extension publication on how to properly drench treat field-grown balled and burlap and containerized nursery stock was given to 100+ nursery growers at the Tennessee Green Industry Field Day during a drench demonstration, but the publication has not been formally published with the university at this time (in process). A calibration chart was developed for bait spreaders and granular insecticides and is currently being used by local extension agents to assist growers with pesticide spreader calibration. The calibration chart has also not been formally published at this time, but is in process.

Results

Nursery growers have information needed to properly utilize imported fire ant baits and to drench treat nursery plants. The information will allow them to be in compliance with the Federal Imported Fire Ant Quarantine, which will benefit the grower's business by avoiding costly fines and penalties. In addition, the information provided to growers will improve their fire ant management programs and reduce the risk of inadvertently shipping fire ants to new areas, which will be a major benefit to the public at large. Calibration and drench trade articles will also provide growers with information needed to properly apply baits and pesticides without exceeding labeled rates, thereby reducing grower costs and protecting the environment.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants

Outcome #3**1. Outcome Measures**

Number of refereed manuscripts produced

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	1	1

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Imported fire ants and Japanese beetles are invasive species that have significant economic consequences when introduced into new areas. The lack of effective quarantine treatments for Japanese beetle and imported fire ants can prevent nursery growers from being able ship nursery products from infested to non infested areas, reducing their potential market area.

What has been done

The following refereed manuscript was published in 2009:

Oliver, J.B., R.K. Vander Meer, S.A. Ochieng, N.N. Youssef, E. Pantaleoni, F.A. Mrema, K.M. Vail, J.P. Parkman, S.M. Valles, W.G. Haun, and S. Powell. 2009. Statewide survey of imported fire ant (Hymenoptera: Formicidae) populations in Tennessee. *J. Entomol. Sci.* 44(2): 1-9.

Results

The imported fire ant survey manuscript provides a statewide over-view of the locations of red, black, and hybrid imported fire ant populations in Tennessee. The survey information is now being used to guide current and planned biological control releases of phorid-decapitating flies. Phorid-decapitating flies have specific preferences for red, black, or hybrid fire ants, so the completed statewide fire ant population survey will improve the establishment success of future imported fire ant biological control efforts in Tennessee.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants

Outcome #4**1. Outcome Measures**

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

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	1	0

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Current post- and pre-harvest treatment methods for imported fire ant and Japanese beetle management in field-grown nursery stock are expensive, hazardous, impractical or require shipping delays. Some treatment methods like the current fire ant post-harvest drench protocol, which requires a twice daily for three consecutive days drench in chlorpyrifos, has multiple problematic issues (i.e., hazardous, expensive, and shipping delays). Unfortunately, many commercial nursery producers continue to use impractical treatment methods like post-harvest drenches and dips because there are no better alternatives at the present time.

What has been done

Studies evaluating post-harvest root ball drench treatments in combination with root ball rotations, Tree Ring post- and pre-harvest irrigation of field-grown nursery stock with insecticides, and tractor applied pre-harvest pyrethroid banded sprays have been performed. Data from post-harvest drench studies are under evaluation by USDA-APHIS for inclusion into the Federal Imported Fire Ant Quarantine.

Results

Research results indicate root ball rotation improves insecticide drenches for both Japanese beetle and imported fire ant control. Tree Ring irrigation devices are also providing effective Japanese beetle grub control with trichlorfon or carbaryl. Tractor-applied pyrethroid band sprays have not been consistent to date, but the addition of individual mound treatments during fall 2009 significantly improved the treatment efficacy. At this time, the reduced drench treatment number in combination with root ball rotation is being evaluated by USDA-APHIS for possible changes in federal fire ant regulations.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants

Outcome #5**1. Outcome Measures**

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

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	0	1

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Treatment options for field grown nursery stock to meet imported fire ant and Japanese beetle quarantines are expensive, time consuming, and limited. Before this project, there were only 3 options to satisfy imported fire ant quarantines for field grown nursery, including a post harvest root ball dip in chlorpyrifos, a post harvest twice daily for three consecutive days drench in chlorpyrifos, or a fire ant bait + granular chlorpyrifos pre harvest treatment. The only practical method for growers among the three approved fire ant treatments was the bait + granular chlorpyrifos option, but producers could not afford this treatment option due to the cost of the granular chlorpyrifos formulation labeled for nursery crops (about \$215 per treated acre). In addition, the granular fire ant treatment must be applied every 84 days and the dip or drench treatments every 30 days, which is a time interval too short for the typical field grown nursery harvesting cycle (generally September to April). For Japanese beetle, there were only two quarantine treatment options for field grown nurseries before this project, including a post harvest root ball dip in chlorpyrifos or a pre harvest band treatment of imidacloprid between May and July. As with fire ants, the dip treatment is not practical for Japanese beetle and the imidacloprid treatment must be applied before fall / winter harvesting begins, which is a cost risk if plant sales demand subsequently declines during the fall and winter.

What has been done

Results from this project have been provided to the USDA APHIS Soil Inhabiting Pests Section, the U.S. Domestic Japanese Beetle Harmonization Plan Regulatory Treatment Review Committee, and to insecticide manufacturing companies to facilitate decision making for changes in regulations and insecticide labels.

Results

A new pre-harvest thiamethoxam (Flagship 25WG and Flagship 0.22G) Japanese beetle treatment was approved in the U.S. Domestic Japanese Beetle Harmonization Plan during 2009 based on research data from this project. The new thiamethoxam treatment has reduced grower costs by an estimated \$208 per acre over the previous best option.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants

Outcome #6**1. Outcome Measures**

Insecticide label changes based on research

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	0	1

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Chlorpyrifos is the only insecticide approved for post harvest treatment of field grown nursery stock in imported fire ant and Japanese beetle quarantines. Chlorpyrifos has been under increased regulatory scrutiny by the U.S. Environmental Protection Agency (EPA). If this chemical becomes unavailable, either through regulatory action of the EPA or from lost manufacturing incentives, then nursery growers would have no alternatives to meet post harvest quarantine certification for fire ants and Japanese beetle grubs.

What has been done

Information was provided to the U.S. Environmental Protection Agency in support of fipronil as a pre-harvest imported fire ant treatment to provide an alternative to the existing granular chlorpyrifos imported fire ant treatment.

Results

During 2009, the U.S. Environmental Protection Agency granted a section 24C emergency use fipronil label for field-grown nursery producers. This is the first non-chlorpyrifos option available to field-grown nursery producers for the management of imported fire ants. Now that a new fipronil label has been granted, the treatment is currently under consideration by regulatory officials for inclusion in the Federal Imported Fire Ant Quarantine.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants

V(H). Planned Program (External Factors)**External factors which affected outcomes**

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

Brief Explanation

{No Data Entered}

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

1. Evaluation Studies Planned

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

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)**Program # 15****1. Name of the Planned Program**

Global Food Security and Hunger: collection & evaluation of Goldenseal with superior properties

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				100%
	Total				100%

V(C). Planned Program (Inputs)**1. Actual amount of professional FTE/SYs expended this Program**

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	2.2
Actual	0.0	0.0	0.0	3.8

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	114858
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	60426
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	185147

V(D). Planned Program (Activity)**1. Brief description of the Activity**

Germplasm evaluation, DNA analysis, cultivation method development.

2. Brief description of the target audience

Medicinal plant industry, small farmers, plant breeders, woodland garden designers, homeowners.

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

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	0	0	0	0
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2009

Plan: 0

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2009	Extension	Research	Total
Plan	0	1	
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Scientific articles pertaining to the identification and improved production practices of Goldenseal.

Year	Target	Actual
2009	1	0

Output #2

Output Measure

- Development of new Goldenseal cultivars

Year	Target	Actual
2009	0	0

Output #3

Output Measure

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

Year	Target	Actual
2009	1	2

Output #4

Output Measure

- Establishment of demonstration areas for improved cultural practices of Goldenseal

Year	Target	Actual
2009	2	2

Output #5

Output Measure

- Cost analysis for Goldenseal production

Year	Target	Actual
2009	0	0

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Number of improved Goldenseal cultivars released
2	Number of techniques defined for improved Goldenseal production
3	Number of demonstration areas for improved Goldenseal production practices established

Outcome #1**1. Outcome Measures**

Number of improved Goldenseal cultivars released

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	0	0

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Small producers in agroforestry need a source of income while trees are growing and maturing. Goldenseal is one possible companion crop.

What has been done

Evaluation of germplasm has begun, including plants obtained from stakeholders. One hundred and sixty goldenseal accessions were collected from sixteen different locations ranging from New York states to Georgia

Results

Plants have been evaluated for flower size and plant size. The flower sizes range from 3/4" to 1 1/2". the sizes of plants varied considerably.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources

Outcome #2**1. Outcome Measures**

Number of techniques defined for improved Goldenseal production

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	0	0

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Small producers in agroforestry need a source of income while trees are growing and maturing. Goldenseal is one possible companion crop.

What has been done

Plants have been collected from seven different locations and are being propagated in nursery containers with standard container growing media (soilless media).

Results

Plants that were maintained in the greenhouse did not do well during the summer and most had defoliated by the fall. During the spring of 2009,. However, they were smaller than in the previous spring.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources

Outcome #3**1. Outcome Measures**

Number of demonstration areas for improved Goldenseal production practices established

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	1	2

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Small producers in agroforestry need a source of income while trees are growing and maturing. Goldenseal is one possible companion crop.

What has been done

Demonstration areas were established in various environments.

Results

Survival between locations of demonstrations were variable. Plots established in wooded areas (i.e. and oak forest) fared much better than open plots.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

{No Data Entered}

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

1. Evaluation Studies Planned

- During (during program)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)**Program # 16****1. Name of the Planned Program**

Global Food Security and Hunger: pathology research to benefit ornamental producers

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				50%
215	Biological Control of Pests Affecting Plants				50%
	Total				100%

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	3.5
Actual	0.0	0.0	0.0	2.7

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	81609
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	42934
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	131552

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research to identify powdery mildew resistance, resistance to cercospora leafspot/blight. Research to identify and catalog soil-borne pathogens prevalent in the Tennessee nursery industry.

2. Brief description of the target audience

Nursery producers, landscape industry, home owners, pathology scientists.

V(E). Planned Program (Outputs)

1. Standard output measures

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	0	0	0	0
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2009

Plan: 0

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2009	Extension	Research	Total
Plan	0	1	
Actual	0	1	1

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Scientific publication concerning disease resistance/susceptibility in hydrangea and identification of soil borne diseases

Year	Target	Actual
2009	2	2

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Increase in number of growers aware of resistant cultivars
2	Increase in number of growers aware of causes of pathogens and their survival
3	Increase in number of growers aware of soil-borne disease prevention methods
4	Percentage of growers with reduced plant mortality by exercising preventative measures
5	Compendium of soil borne pathogens of economic importance to the Tennessee nursery industry
6	Percentage of Tennessee growers aware of disease resistant hydrangea cultivars

Outcome #1

1. Outcome Measures

Increase in number of growers aware of resistant cultivars

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	75	75

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Information will reduce fungicide use in the nursery industry, thus reducing the amount of pesticides entering the environment. This information will also reduce production costs for nursery producers, resulting in a net increase in income.

What has been done

Presented preliminary data in a poster presentations at regional nursery production trade show (Southern Nursery Association) and published two research conference proceeding describing the results.

Results

Conference attendees have now increased knowledge of resistant hydrangea cultivars.

4. Associated Knowledge Areas

KA Code	Knowledge Area
212	Pathogens and Nematodes Affecting Plants

Outcome #2

1. Outcome Measures

Increase in number of growers aware of causes of pathogens and their survival

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	75	75

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Information will reduce fungicide use in the nursery industry, thus reducing the amount of pesticides entering the environment. This information will also reduce production costs for nursery producers, resulting in a net increase in income.

What has been done

Information was communicated to producers at the Southern Nursery Association Research Conference and Trade Show via a poster presentation.

Results

More people are aware that plant mortality may not necessarily be caused by Phytophthora.

4. Associated Knowledge Areas

KA Code	Knowledge Area
212	Pathogens and Nematodes Affecting Plants

Outcome #3

1. Outcome Measures

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

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	75	75

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Growers need to know diseases causing plant death or declining plant health.

What has been done

Surveys of commercial nurseries were conducted to identify pathogens that are associated with plant death or declining plant health.

Results

Different species of Phytophthora were isolated from plant tissue, soil and irrigation water. Heterobasidium, Fusarium and Pestalotiopsis were also isolated.

4. Associated Knowledge Areas

KA Code	Knowledge Area
212	Pathogens and Nematodes Affecting Plants

Outcome #4

1. Outcome Measures

Percentage of growers with reduced plant mortality by exercising preventative measures

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Compendium of soil borne pathogens of economic importance to the Tennessee nursery industry

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

This information is important to nursery growers in the south and southeast US.

What has been done

Information was presented to nursery producers in the form of a poster display at the Southern Nursery Association Trade Show.

Results

Incidence of Phytophthera and other pathogens was communicated.

4. Associated Knowledge Areas

KA Code	Knowledge Area
212	Pathogens and Nematodes Affecting Plants

Outcome #6

1. Outcome Measures

Percentage of Tennessee growers aware of disease resistant hydrangea cultivars

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	10	10

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Commercial nurseries that produce Hydrangea will use these cultivars to decrease pesticide needs and improve profits.

What has been done

Disease resistant cultivars have been identified.

Results

Cultivars resistant to powdery mildew and other foliar diseases were identified; information communicated to producers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
212	Pathogens and Nematodes Affecting Plants

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

{No Data Entered}

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

1. Evaluation Studies Planned

- Before-After (before and after program)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 17

1. Name of the Planned Program

Global Food Security and Hunger: controlling imported fire ants using behavior modifying chemicals

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
211	Insects, Mites, and Other Arthropods Affecting Plants				100%
	Total				100%

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	3.5
Actual	0.0	0.0	0.0	4.1

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	123925
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	65196
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	199764

V(D). Planned Program (Activity)

1. Brief description of the Activity

The research proposed under this project will identify compounds useful in keeping fire ants out of nursery plants that are being held for shipment as well as from areas where they are a nuisance and where it is not practical to use conventional insecticides because of health and environmental concerns.

2. Brief description of the target audience

Nursery producers, schools, parks and recreational facilities, nursing homes.

V(E). Planned Program (Outputs)

1. Standard output measures

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	0	0	0	0
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2009

Plan: 0

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2009	Extension	Research	Total
Plan	0	1	
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Scientific publications describing the isolation, characterization and efficacy of behavior modifying chemicals in fire ant.

Year	Target	Actual
2009	1	0

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Increase in number of growers with increased awareness of issue
2	Percentage of nurseries adopting control strategies using newly discovered chemicals

Outcome #1

1. Outcome Measures

Increase in number of growers with increased awareness of issue

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	100	190

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Control of imported fire ant is important for the agricultural industries of Tennessee and for public well being. Species specific imported fire ant attractants/repellents will target fire ant without adversely impacting native ant species and beneficial insects.

What has been done

Poisson and Dufours glands have been extracted from red, black and hybrid fire ant species. Analysis of the glands has been completed.

Results

Research results presented to stakeholders during field day events. Field evaluation of laboratory findings is in progress.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants

Outcome #2

1. Outcome Measures

Percentage of nurseries adopting control strategies using newly discovered chemicals

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Control of imported fire ant is important for the agricultural industries of Tennessee and for public well being. Species specific imported fire ant attractants/repellents will target fire ant without adversely impacting native ant species and beneficial insects.

What has been done

Poisson and Dufours glands have been extracted from red, black and hybrid fire ant species. Analysis of the glands has been completed.

Results

Field evaluation of the extracts are underway. Communication of results will continue.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

{No Data Entered}

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

1. Evaluation Studies Planned

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

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)**Program # 18****1. Name of the Planned Program**

Global Food Security and Hunger: evaluation and characterization of heirloom vegetable varieties

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				50%
205	Plant Management Systems				50%
	Total				100%

V(C). Planned Program (Inputs)**1. Actual amount of professional FTE/SYs expended this Program**

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	3.5
Actual	0.0	0.0	0.0	3.7

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	111835
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	58836
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	180275

V(D). Planned Program (Activity)**1. Brief description of the Activity**

Conduct field, greenhouse and laboratory research experiments; install and evaluate field demonstration plots.

2. Brief description of the target audience

Agricultural research community, crop producers, plant breeders, retailers of vegetable and ornamental plant seeds, Extension agents, policy makers, homeowners.

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

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	0	0	0	0
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2009

Plan: 0

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2009	Extension	Research	Total
Plan	0	2	
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Scientific publications pertaining to adaptation and characterization of heirloom varieties of tomato, pepper and eggplant.

Year	Target	Actual
2009	2	2

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

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 linkage maps developed to facilitate marker-assisted breeding
5	Number of graduate students trained in DNA based plant characterization techniques
6	Number of DNA fingerprinting protocols established for true-to-type identification
7	Number of protocols for DNA characterization to establish true-to-type identification of varieties examined in project
8	Number of significant functional elements (such as amino acids and vitamins) characterized in heirloom varieties

Outcome #1**1. Outcome Measures**

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

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	20	20

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Organic growers benefit when growing unique crops that are not available in grocery stores. Heirloom cultivars provide this needed crop.

What has been done

During the course of this research, 24 heirloom varieties, primarily tomato, were evaluated for productivity, ease of cultivation and taste.

Results

Several methods of cultivation were evaluated. The two staking methods produced up to 70% more marketable fruits than those grown on ground beds. All cultivars produced ample fruits and were all suitable for production under middle Tennessee conditions. In taste tests, the ten best-producing cultivars were evaluated. Heavy rainfall have negatively affected production and quality.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
205	Plant Management Systems

Outcome #2**1. Outcome Measures**

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

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	25	25

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Heirloom tomato cultivars are highly sought after by home gardeners and commercial organic growers.

What has been done

Demonstration areas for heirloom varieties were established at the TSU Research and Demonstration Farm.

Results

Home gardener tours of the demonstration areas resulted in positive responses to the cultivars. Groups of high school students and other school groups visited the plots and the greenhouses where transplants were being propagated. The students were instructed in plant growth and propagation and took heirloom varieties of plants to plant in their home gardens.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
205	Plant Management Systems

Outcome #3

1. Outcome Measures

Additional number of students gaining knowledge of heirloom variety characteristics

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	10	6

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Production practices associated with heirloom varieties were incorporated into the plant propagation course currently being taught at TSU.

What has been done

Students received classroom instruction and hands-on laboratory instruction on the qualities of heirloom varieties and techniques used in propagation heirlooms varieties.

Results

Students gained knowledge and disseminated the knowledge by distributing transplants to family and friends.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
205	Plant Management Systems

Outcome #4

1. Outcome Measures

Number of linkage maps developed to facilitate marker-assisted breeding

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Number of graduate students trained in DNA based plant characterization techniques

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	1	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Molecular biology has advanced the knowledge base in biological science and technology at an unprecedented rate. Students should understand these principles since they need to take informed positions on the practical and ethical implications of such technologies, and may use them in the workplace.

What has been done

5 graduate students have been trained in molecular markers, AFLP analyses and DNA sequencing electrophoresis procedures and applications. In addition undergraduate and pre-college students were also exposed to such techniques.

Results

A graduate student on this project presented research findings at a national symposium: Molecular Markers in Horticulture Symposium, Oregon State University, Corvallis, OR, USA on July 29-August 1, 2009.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources

Outcome #6

1. Outcome Measures

Number of DNA fingerprinting protocols established for true-to-type identification

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	1	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Molecular markers are excellent tool for true to type identification of authentic plant material in order to ascertain their genuineness. AFLP is therefore a tool of choice since its reliability is based on two molecular techniques i.e., restriction digest and DNA amplification.

What has been done

Procedures were standardized for the use of IRD-800 and IRD-700 labeled primers for automated analyses of tomato and pepper varieties. 20 AFLP primer pairs were found suitable both in bulk and segregated analyses to provide ample molecular markers' amplification for each tomato and pepper variety. AFLP profiles were generated to distinguish each tomato and pepper heirloom variety.

Results

More than 300 AFLP based DNA-fragments were generated via dual-dye AFLP analyses to compare genetic similarity between each of the six tomato varieties (Andrew Rahat Jumbo, Brandy Wine, Brimmer, Marizol Red, Russian & Tidwell German) and nine pepper varieties (Anaheim, Cayenne, Cowhorn, Cubanelle, Habanera, Poblano Ancho, Red Bell, Serrano & Tabasco). Development of these tools can thus distinctively identify each variety for their characters and propriety issues etc.

4. Associated Knowledge Areas

KA Code **Knowledge Area**
 202 Plant Genetic Resources

Outcome #7

1. Outcome Measures

Number of protocols for DNA characterization to establish true-to-type identification of varieties examined in project

Not Reporting on this Outcome Measure

Outcome #8

1. Outcome Measures

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

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	2	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Peppers and tomatoes are among the top vegetable species consumed in the United States. Consumers are interested in knowing the nutritional value, especially the functional elements contained in these plants. Providing this knowledge to the public will assist in promoting a healthy diet.

What has been done

Peppers were harvested and stored at -70C. Extracts of amino acids were obtained. These samples will be analyzed for amino acid species soon.

Results

Five graduate students worked on growing and harvesting the fruits, and participated in preparation of different extracts from tomato and pepper fruits. Analysis of amino acids is in progress.

4. Associated Knowledge Areas

KA Code **Knowledge Area**
 202 Plant Genetic Resources

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Appropriations changes
- Public Policy changes
- Government Regulations
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

{No Data Entered}

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

1. Evaluation Studies Planned

- Retrospective (post program)
- During (during program)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)**Program # 19****1. Name of the Planned Program**

Analyzing the green industry and related sub-sectors in Tennessee: challenges and prospects

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
601	Economics of Agricultural Production and Farm Management				50%
604	Marketing and Distribution Practices				50%
	Total				100%

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	2.2
Actual	0.0	0.0	0.0	2.7

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	81609
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	42934
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	131552

V(D). Planned Program (Activity)

1. Brief description of the Activity

Provide information to green industry and related sub-sector service providers at special events such as trade shows and field days.

2. Brief description of the target audience

Green industry producers, landscape businesses, consumers of green industry products and services, and policy makers.

V(E). Planned Program (Outputs)

1. Standard output measures

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	0	0	0	0
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2009

Plan: 0

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2009	Extension	Research	Total
Plan	0	1	
Actual	0	2	2

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Scientific publications and policy papers relating to economic analysis of the green industry in Tennessee

Year	Target	Actual
2009	1	4

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Number of additional producers with potential problems, knowledge of exports and their information needs determined
2	Number of producers with an increase in exports of nursery products and income.
3	Percentage of program participants with increased sales and income
4	Percentage of program participants receiving assistance in decreasing knowledge gaps, marketing and market access
5	Percentage of program participants with increased knowledge of exports potential and opportunities by producers
6	Number of producers with with an increase in with increased sales and income.
7	Number of program participants receiving assistance in decreasing knowledge gaps, marketing and market access
8	Number of producers with increased knowledge of exports potential and opportunities by producers.

Outcome #1**1. Outcome Measures**

Number of additional producers with potential problems, knowledge of exports and their information needs determined

Not Reporting on this Outcome Measure

Outcome #2**1. Outcome Measures**

Number of producers with an increase in exports of nursery products and income.

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	20	40

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Nursery business owners are interested in the general performance of the sub sector to ensure profitability. This applies both to the domestic and export markets. Volatility in exports is related to a number of issues including transaction costs and regulations. From the vantage point of nursery exporting businesses there is need to ensure stability in income.

What has been done

A mail survey was used to gauge the key issues of trade, regulations and transaction costs. The latter represents costs that are incurred to carry out a transaction both prior to and after sale pertaining to search, bargaining and contracting as well as monitoring cost. Business owners strive to minimize transaction costs to acquire adequate income.

Results

Analysis of the data revealed that sanitary and phytosanitary regulations and lack of knowledge about trade legislation and associated policy parameters in the countries to which products are exported represent key sources of transaction costs.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices

Outcome #3

1. Outcome Measures

Percentage of program participants with increased sales and income

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Percentage of program participants receiving assistance in decreasing knowledge gaps, marketing and market access

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Percentage of program participants with increased knowledge of exports potential and opportunities by producers

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Number of producers with with an increase in with increased sales and income.

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	{No Data Entered}	20

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Given that nursery businesses provide employment and income for a number of people it is important to understand issues which impact increase in sales and income which affect people's livelihood.

What has been done

A case study approach was used to solicit information from state agricultural marketing agency regarding sales. Knowledge gained was critical in enhancing income of businesses engaged in export.

Results

To be successful in the export business a number of strategies were pursued. These include attending trade shows; visiting key export destinations and showcasing own business by inviting visitors. It was also important to assess the utility and cost effectiveness of alternative marketing channels such as direct sale to consumers versus selling through agents.

4. Associated Knowledge Areas

KA Code	Knowledge Area
604	Marketing and Distribution Practices

Outcome #7**1. Outcome Measures**

Number of program participants receiving assistance in decreasing knowledge gaps, marketing and market access

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	{No Data Entered}	200

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Access to relevant information which will enable business operations to fully participate in the market place is crucial. Close examination of this issue is important to understand their competitiveness. Landscape businesses are an important component of the nursery and greenhouse business. They provide a wide range of services including landscape and turf grass maintenance as well as plant installation.

What has been done

A survey of landscape businesses in the Nashville area was conducted to acquire feedback on operations of the businesses, including their size, gap in knowledge about the business, opportunities and challenges. It is important to get an understanding of the above issues to assess how well the businesses are doing.

Results

It was found that landscape services are very closely linked to nursery businesses. They range in size from small to large. Labor availability, weed suppression, water supply and pest regulations are noted to be major problems. Services provided by landscape businesses include landscape and turf maintenance as well as plant installation. Results of the survey provide insights on a number of issues relating to landscape businesses.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices

Outcome #8**1. Outcome Measures**

Number of producers with increased knowledge of exports potential and opportunities by producers.

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	{No Data Entered}	20

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Increase in knowledge of export potential and opportunities for producers will enable businesses to enter the international market thereby expanding their market base and associated income.

What has been done

Data on nursery exporting businesses was acquired from the Tennessee Department of Agriculture covering a few years. This was the best available data at this time that could be used to assess the trend in knowledge of nursery products export potential that will benefit businesses.

Results

A review of nursery exports from Tennessee indicated that only few businesses were engaged in pursuing export opportunities. This may be due to a number of reasons including differences in the level of knowledge about export potential among nursery business owners. This difference could persist as long as there is no information shared among businesses. The existence of asymmetric information limits knowledge about export opportunities and potential income that could have been obtained.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices

V(H). Planned Program (External Factors)**External factors which affected outcomes**

- Economy
- Public Policy changes
- Government Regulations
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

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

1. Evaluation Studies Planned

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

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)**Program # 20****1. Name of the Planned Program**

Impact of the tobacco buyout program and strategies to promote economic viability of small farmers

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

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
604	Marketing and Distribution Practices				80%
610	Domestic Policy Analysis				20%
	Total				100%

V(C). Planned Program (Inputs)**1. Actual amount of professional FTE/SYs expended this Program**

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	3.2
Actual	0.0	0.0	0.0	2.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	60451
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	31803
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	97446

V(D). Planned Program (Activity)**1. Brief description of the Activity**

Focus group meetings will be used to develop a comprehensive survey instrument to be used for collecting data on the current situation and future prospects on various issues in small farm operations. Enterprise budget forms will also be developed to collect data necessary to conduct economic analysis. Results derived from analyses will be made available to farmers to assist them to be economically viable. Brochures, fact sheets and other publications containing project results will be developed and distributed to various stakeholders.

2. Brief description of the target audience

Small farmers, extension educators, and policy makers.

V(E). Planned Program (Outputs)

1. Standard output measures

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	0	0	0	0
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2009

Plan: 0

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2009	Extension	Research	Total
Plan	0	1	
Actual	0	2	2

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Scientific publications pertaining to the impact of the tobacco buyout program and strategies to promote economic viability of small farmers

Year	Target	Actual
2009	1	1

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Percentage of program participants with increased awareness about alternative crops
2	Percentage of program participants with improved record keeping, management and marketing skills
3	Number of additional producers adopting alternative crop production
4	Percentage of program participants with increased farm income
5	Number of additional producers adopting alternative crop production.

Outcome #1**1. Outcome Measures**

Percentage of program participants with increased awareness about alternative crops

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	100	400

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Small farmers have been facing a number of challenges over the years in different areas. The key challenge for small farmers has been maintaining adequate level of income. Changing policies, development of new technologies, globalization and increasing concentration in agriculture have compounded the challenge. Given that small farmers account for over 93 percent of all farms in the United States, the issue is concern at community, regional and national levels as well. One recent policy change involves tobacco which no longer receives government support. This calls for increased awareness about alternative enterprises to secure a source of income replacing tobacco.

What has been done

A comprehensive mail survey was used to gather data on various issues. Farmers were selected from a data base provided by the Farm Service Agency. This provided insights that could be used to enhance the viability of small farmers. Presentations were made at various conferences such as the National Small Farm Conference and annual Tennessee State University Small Farm Expo. Pigeonpea, an alternative niche crop, was being introduced to farmers by getting them to plant it in their fields and by setting up demonstrations on Tennessee State University Research Stations. The benefit of adopting the crop has also been presented at regional meetings attended by diverse stakeholders.

Results

Over two third of the farmers indicated business climate is getting worse with challenges in the areas of finance, farm labor availability and marketing. Survey results show very few responses to the issue of awareness about alternative enterprises. A significant number of the respondents indicated that they have not participated in any training workshops.

4. Associated Knowledge Areas

KA Code	Knowledge Area
604	Marketing and Distribution Practices

Outcome #2

1. Outcome Measures

Percentage of program participants with improved record keeping, management and marketing skills

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Number of additional producers adopting alternative crop production

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	50	20

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Adopting alternative enterprises by small farmers has become critical with the changing policies and conditions in the market place characterized by competition. This is the case both in the domestic and global markets. Farmers should be familiar with measures that will reduce cost and enhance their return.

What has been done

As part of the comprehensive mail survey mentioned earlier, farmers were asked two questions pertaining to adoption of alternative enterprises. First, whether or not they had adopted any alternatives enterprise and second how profitable the products were in comparison to profit that they used to get from tobacco. This was aimed at understanding what options farmers were pursuing and the associated level of profitability.

Results

Ninety one percent of the respondents indicated that they did not raise tobacco since the buyout in 2005. Despite this response, adoption of alternative enterprises had not yet taken root. It required demonstrating economic viability of alternatives to farmers. This suggested that adoption of alternative enterprises would take effort and time to implement.

4. Associated Knowledge Areas

KA Code	Knowledge Area
604	Marketing and Distribution Practices

Outcome #4**1. Outcome Measures**

Percentage of program participants with increased farm income

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	50	20

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

There are two possible sources of income for farmers. These are income from farming and off farm employment. The former indicates that farming is a full time job while the later implies part time farming. It is generally the case that farmers largely derive income from both sources. Availability of off farm jobs depend on the prevailing local economic conditions. The increase in farm income depends on a number of issues including competitiveness of the farm business, level and frequency of one to one assistance provided by the extension service, availability and cost of inputs and the level of price for the product.

What has been done

In the comprehensive mail survey mentioned earlier, farmers were asked if their income from farming had increased to assess its magnitude and design strategies to enhance their viability.

Results

About 60 percent of the respondents indicated that they worked off farm. They stated that they did not work more hours off farm after the tobacco buyout. Change in household net income and gross agricultural receipt from total farm operations between 2005 and 2007 showed a decline. This may be due to a number of reasons including loss of tobacco income, high input costs and low product prices.

4. Associated Knowledge Areas

KA Code	Knowledge Area
604	Marketing and Distribution Practices

Outcome #5**1. Outcome Measures**

Number of additional producers adopting alternative crop production.

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	50	20

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Farm diversification is an important risk management tool that can reduce volatility in income. Farmers need stable income to support themselves, their families as well as continue their farm operations.

What has been done

Small farmers were introduced to two enterprises. The first was pigeonpea, a legume niche crop, which has substantial domestic and global demand due to its high protein content. It can be grown for human consumption as well as for animal feed. Initial field trial and demonstration was conducted on the Tennessee State University (TSU) farm in the past two years. Results from the trials were presented at the annual TSU Small Farm Expo and joint meeting of the Association of Extension Administrators and the Association of Research Directors. These meetings are attended by small farmers, extension agents and policy makers. The second enterprise was switch grass, that is also being introduced to selected farmers. It can grow on less fertile soil and be used as an input for bio fuel.

Results

Assessment of local demand for pigeonpea showed that it can be sold at a premium price. Some farmers have previously grown the crop on their fields. Additional farmers received seed to grow it and will serve as demonstration for other farmers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
604	Marketing and Distribution Practices

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Public Policy changes
- Government Regulations

Brief Explanation

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

1. Evaluation Studies Planned

- Before-After (before and after program)

- During (during program)
- Case Study
- Comparisons between program participants (individuals, group, organizations) and non-participants

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)**Program # 21****1. Name of the Planned Program**

Evaluation of poinsettias and seasonal alternative crops for production in Tennessee

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				80%
205	Plant Management Systems				10%
211	Insects, Mites, and Other Arthropods Affecting Plants				10%
	Total				100%

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	2.3
Actual	0.0	0.0	0.0	1.1

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	33248
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	17492
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	53595

V(D). Planned Program (Activity)

1. Brief description of the Activity

Conduct greenhouse trials of a range of poinsettia cultivars and other seasonal crops. Partner with major U.S. suppliers. Provide training to growers, industry customer reps, and homeowners. Conduct poinsettia open house at which consumer preferences will be surveyed. Generate production and marketing information on new and established poinsettia cultivars as well as alternative seasonal crops.

2. Brief description of the target audience

Crop producers, plant breeders, retailers and marketers of ornamental plants, extension agents, homeowners

V(E). Planned Program (Outputs)

1. Standard output measures

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	0	0	0	0
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2009

Plan: 0

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2009	Extension	Research	Total
Plan	0	1	
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Scientific publications concerning traditional and novelty poinsettias and marketing trends with poinsettias and seasonal crops.

Year	Target	Actual
2009	1	0

Output #2

Output Measure

- Number of students receiving training in seasonal crop production and marketing

Year	Target	Actual
2009	2	2

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Number of cultivars of seasonal crops evaluated
2	Number of participants in consumer preference analysis
3	Number of students receiving training in seasonal crop production and marketing

Outcome #1**1. Outcome Measures**

Number of cultivars of seasonal crops evaluated

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	50	41

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Poinsettia is a leading seasonal greenhouse crop. Each year many new varieties of Poinsettia are introduced. For producers, or potential producers, to make wise choices about the best variety to produce in their area, they need information on consumer preference and technical production information.

What has been done

New and established varieties of poinsettia were propagated and grown to finish. A poinsettia field day was held for general public and greenhouse professionals to rate varietal preference. These data were combined with production data. Some varieties that were planned for testing this year were unavailable.

Results

Consumer and producer preference data were communicated to the producer community via trade publication outlets.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants

Outcome #2**1. Outcome Measures**

Number of participants in consumer preference analysis

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	300	361

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Poinsettia is a leading seasonal greenhouse crop. Each year many new varieties of Poinsettia are introduced. For producers, or potential producers, to make wise choices about the best variety to produce in their area, they need information on consumer preference. A means to gauge this consumer preference is to have consumers rate a representative variety of poinsettia cultivars for preferred color, stature, etc.

What has been done

New and established varieties of poinsettia were propagated and grown to finish. A poinsettia field day was held for general public and greenhouse professionals to rate varietal preference. These data were combined with production data.

Results

361 persons attended the field day. A high proportion filled out consumer preference surveys. The information has been summarized and conveyed via trade publications.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
205	Plant Management Systems

Outcome #3

1. Outcome Measures

Number of students receiving training in seasonal crop production and marketing

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	2	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

It is important to train the next generation of agricultural scientists. One aspect of this training is hands on experiential learning.

What has been done

Two undergraduate students were hired to work on this project, the students participated all aspects of the project: varietal selection, plant propagation and maintenance staging of the field day and tabulation of data.

Results

Undergraduate students received hands on experiential learning opportunity in greenhouse crop management and consumer preference analysis.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Other (Producer profitability)

Brief Explanation

{No Data Entered}

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

1. Evaluation Studies Planned

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

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)**Program # 22****1. Name of the Planned Program**

Evaluating strategies to promote the goat meat industry in Tennessee

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

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
502	New and Improved Food Products				10%
604	Marketing and Distribution Practices				90%
	Total				100%

V(C). Planned Program (Inputs)**1. Actual amount of professional FTE/SYs expended this Program**

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	2.0
Actual	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)**1. Brief description of the Activity**

Case studies with representative goat producers to conduct economic analysis of various marketing channels in use.

Focus group meetings with local retail businesses to assess the potential to make goat meat available at mainstream local retail markets.

Primary survey of non-traditional consumers to evaluate the extent of goat meat acceptance.

Primary survey of traditional goat consumers to identify issues and problems faced in local goat meat markets and their willingness to pay for desired quality and preferences.

Meetings with goat producers, association and other related groups to promote goat industry.

2. Brief description of the target audience

Goat producers
 Traditional consumers (individuals who eat goat meat)
 Non-traditional consumers (individuals who have never eaten goat meat before)
 Goat producers and marketing associations
 Local restaurants and food businesses

Policy makers

V(E). Planned Program (Outputs)

1. Standard output measures

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	0	0	0	0
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2009
 Plan: 0
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2009	Extension	Research	Total
Plan	0	2	
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Scientific publications concerning strategies to promote the goat meat industry in Tennessee

Year	Target	Actual
2009	2	0

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Increase in number of goat producers with knowledge of efficient marketing techniques
2	Increase in number of local restaurants and businesses with knowledge of potential goat meat demand by consumers.
3	Increase in number of goat producers educated in specific consumer preferences
4	Increase in demand for goat meat in Tennessee by non-traditional new consumers in Tennessee.
5	Percent increase in goat meat production in Tennessee

Outcome #1

1. Outcome Measures

Increase in number of goat producers with knowledge of efficient marketing techniques

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Increase in number of local restaurants and businesses with knowledge of potential goat meat demand by consumers.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Increase in number of goat producers educated in specific consumer preferences

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Increase in demand for goat meat in Tennessee by non-traditional new consumers in Tennessee.

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Percent increase in goat meat production in Tennessee

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Government Regulations
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

This program had one Principal Investigator associated with it to conduct the bulk of the research. This PI has taken a leave of absence from the university, preventing the completion of the stated goals. This program has been removed from our Plan of Work.

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

1. Evaluation Studies Planned

- Retrospective (post program)
- During (during program)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}