2010 Tennessee State University Research Annual Report of Accomplishments and Results

Status: Accepted

Date Accepted: 06/15/2011

I. Report Overview

1. Executive Summary

This report consists of the FY 2010 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 NIFA priority areas. This past year, we have taken steps to bolster our capacity in the priority areas by hiring a number of new faculty to specifically address areas such as biofuels and food safety. Even though the program titles in this report may have been modified to illustrate the NIFA goal that is addressed in each particular program, the goal of agriculture research at TSU remains the same: to generate and communicate new 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 employs a 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 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: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	55.0
Actual	0.0	0.0	0.0	76.8

II. Merit Review Process

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

- ☑ Internal University Panel
- ☑ External University Panel
- ☐ External Non-University Panel
- ☐ Combined External and Internal University Panel
- ☐ Combined External and Internal University External Non-University Panel
- ☐ Expert Peer Review
- ☐ Other

2. Brief Explanation

Each Planned Program in this Annual Report was approved by an internal review panel, some programs had the extra benefit of an additional review by an external panel These panels were composed of agricultural researchers and 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 successfully met all criteria 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

- ☐ Use of media to announce public meetings and listening sessions
- ☑ Targeted invitation to traditional stakeholder groups
- ☐ Targeted invitation to non-traditional stakeholder groups
- ☑ Targeted invitation to traditional stakeholder individuals
- ☐ Targeted invitation to non-traditional stakeholder individuals
- ☑ Targeted invitation to selected individuals from general public
- ☑ Survey of traditional stakeholder groups
- ☑ Survey of traditional stakeholder individuals
- ☐ Survey of the general public
- ☐ Survey specifically with non-traditional groups
- ☐ Survey specifically with non-traditional individuals
- ☐ Survey of selected individuals from the general public
- ☐ Other

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 forestry work closely with the Tennessee Urban Forestry Council, those programs examining new sources of feed stock for biofuels utilize the expertise and stakeholder evaluation available in our state Plant Material Advisory Committee and Plant Materials Committee. Our environmental programs still maintain a close relationship with the Cumberland River Compact, a non-profit organization concerned with the health and wellbeing 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, Professional Grounds

Maintenance Association, Tennessee Goat Producers Association, Southern Nursery Association, Guinea Fowl Breeders Association) are routinely utilized for input and direction. In other cases, individuals are contacted and participation is 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
- ☐ Use External Focus Groups
- ☐ Open Listening Sessions
- ☑ Needs Assessments
- ☑ Use Surveys
- ☑ Other (See explanation below.)

Brief explanation.

Our methods to identify appropriate stakeholders have not changed much: they are identified through methods most suitable for a specific program. Our goal is to identify stakeholders in a manner that will provide 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. Individual stakeholders 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 with the general public (open meeting advertised to all)
- ☐ Survey of the general public
- ☐ Meeting specifically with non-traditional groups
- ☐ Survey specifically with non-traditional groups
- ☑ Meeting specifically with non-traditional individuals
- ☑ Survey specifically with non-traditional individuals
- ☐ Meeting with invited selected individuals from the general public
- ☐ Survey of selected individuals from the general public

- ☐ Other

Brief explanation.

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

- ☐ In the Budget Process
- ☑ To Identify Emerging Issues
- ☐ Redirect Extension Programs
- ☑ Redirect Research Programs
- ☐ In the Staff Hiring Process
- ☐ In the Action Plans
- ☑ To Set Priorities
- ☐ Other

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

As in previous years, a central concern of stakeholders, regardless of area of research, has been one of economics: How do maximize profits? How do we minimize expenses? How do I feed my family with less money? 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) Desire increased assistance in complying with local, state and federal laws, particularly those pertaining to pesticide application.
2) Are looking to academia with increased frequency for advice on the means to cope with difficult economic conditions.
3) Understand the problems associated with unhealthy lifestyles (i.e. obesity), but are reluctant to employ lifestyle changes to correct the problem.
4) Have a greater understanding of the justifications behind various agricultural quarantines than previously believed.
5) Stakeholders in the poultry industry do not share a universal set of concerns: the major constraint in guinea fowl production is identified as lack of knowledge of nutrient requirements and management; whereas the broiler producer is constrained by excessive fat deposition.

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	3117643

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	0	0	0	1686835
Actual Matching	0	0	0	1601819
Actual All Other	0	0	0	2237491
Total Actual Expended	0	0	0	5526145

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	0	0	0	1686835

V. Planned Program Table of Content

S. No.	PROGRAM NAME
1	Global Food Security and Hunger - Enhancing prosperity of small farms.
2	Global Food Security and Hunger -Molecular approaches for the study of microorganisms in
3	Childhood Obesity -Improving families through better nutrition and enhanced well-being.
4	Global Food Security and Hunger - Monitor and mitigate environmental impacts of
5	Global Food Security and Hunger- Improving agricultural plants through reduced response to
6	Food Safety - Research to mitigate food-borne illness.
7	Global Food Security and Hunger - Reducing plant pest problems using environmentally

Add previously unplanned program

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Global Food Security and Hunger - Enhancing prosperity of small farms.

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

Add knowledge area

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	19.7
Actual	0.0	0.0	0.0	29.8

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	654527
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	0	621539
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	868193

V(D). Planned Program (Activity)

1. Brief description of the Activity

Conduct field, greenhouse and laboratory research experiments on heirloom and medicinal crops. Germplasm evaluation, DNA analysis, cultivation method development.
Generate a cDNA library for the guinea fowl. Develop chicken, guinea fowl and meat goat genetic resource populations. Use microArray to identify adipose specific transcriptome. Evaluate concentrate supplementation options for meat goat performance.
Determine optimum floor space allowance for guinea fowl. Determine optimum requirement for dietary calcium and phosphorus by guinea fowl and determine optimum dietary requirement for methionine and lysine by guinea fowl.
Conduct genetic and environmental research to enhance meat goat longitudinal doe performance, conduct producer workshops on assessing does for fitness and reproductive output.
Hold focus group meetings to develop a comprehensive survey instrument for collecting data on the current situation and future prospects on various issues in small farm operations. Develop enterprise budget forms to collect data necessary to conduct economic analysis. Make results derived from analyses available to farmers to assist them to be economically viable.
Develop brochures, fact sheets and other publications containing project results and distribute to stakeholders. Provide information to green industry and related sub-sector service providers at special events such as trade shows and field days.

2. Brief description of the target audience

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

V(E). Planned Program (Outputs)

1. Standard output measures

2010	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: 2010
Plan: 0
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Plan	0	7	
Actual	0	7	7

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Development of new Goldenseal cultivars.

☑ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	0	0

Output #2

Output Measure

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

☑ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	0	0

Output #3

Output Measure

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

☑ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	0	0

Output #4

Output Measure

- Cost analysis for Goldenseal production.

☑ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	0	0

Output #5

Output Measure

- Evaluation of livestock management techniques for economic feasibility.

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	1	1

Output #6

Output Measure

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

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	1	1

Output #7

Output Measure

- Construction of cDNA library for Guinea fowl.

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	1	3

Output #8

Output Measure

- Dietary recommendations to guinea fowl producers for optimal production.

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	1	1

Output #9

Output Measure

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

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	0	0

Output #10

Output Measure

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

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	1	1

Output #11

Output Measure

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

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	30	40

Output #12

Output Measure

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

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	1	1

Output #13

Output Measure

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

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	1	1

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 DNA profiles developed to facilitate marker-assisted breeding.
5	Number of graduate students trained in DNA based plant characterization techniques.
6	Number of protocols for DNA characterization to establish true-to-type identification of varieties.
7	Number of significant functional elements (such as amino acids and vitamins) characterized in heirloom varieties.
8	Number of improved Goldenseal cultivars released.
9	Number of techniques defined for improved Goldenseal production.
10	Increase in number of producers with an increase in exports of nursery products and producers' income.
11	Increase in number of producers with increased sales and income.
12	Increase in number of producers receiving assistance in decreasing knowledge gaps, marketing and market access.
13	Increase in number of producers with increased knowledge of exports potential and opportunities by producers.
14	Increase in number of producers with increased awareness of alternative crops.
15	Increase in number of producers adopting alternative crop production.
16	Increase in number of producers with increased farm diversification.
17	Number of adipose-specific genes identified in alternative poultry species.

18	Number of alternative poultry birds examined in genetic resource population.
19	Number of meat goats screened for genetic markers.
20	Percentage of Guinea fowl producers realizing savings in feeding costs.
21	Percentage of producers implementing recommendations for optimized Guinea fowl production.
22	Percentage of Guinea fowl producers realizing profitability after adoption of recommendations.

Add Cross-cutting Outcome/Impact Statement or Unintended or Previously Unknown Outcome Measure

Outcome #1

1. Outcome Measures

☑ Not Reporting on this Outcome Measure

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
◯ Change in Action Outcome Measure
◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	20	0

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

- ☑ 202 - Plant Genetic Resources
- ☑ 205 - Plant Management Systems
- ☐ 301 - Reproductive Performance of Animals
- ☐ 302 - Nutrient Utilization in Animals
- ☐ 303 - Genetic Improvement of Animals
- ☐ 304 - Animal Genome
- ☐ 307 - Animal Management Systems
- ☐ 601 - Economics of Agricultural Production and Farm Management
- ☐ 604 - Marketing and Distribution Practices
- ☐ 610 - Domestic Policy Analysis

Outcome #2

1. Outcome Measures

☑ Not Reporting on this Outcome Measure

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
- ◯ Change in Action Outcome Measure
- ◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	25	0

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 were 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

- ☑ 202 - Plant Genetic Resources
- ☑ 205 - Plant Management Systems
- ☐ 301 - Reproductive Performance of Animals
- ☐ 302 - Nutrient Utilization in Animals
- ☐ 303 - Genetic Improvement of Animals
- ☐ 304 - Animal Genome
- ☐ 307 - Animal Management Systems
- ☐ 601 - Economics of Agricultural Production and Farm Management
- ☐ 604 - Marketing and Distribution Practices
- ☐ 610 - Domestic Policy Analysis

Outcome #3

1. Outcome Measures

☑ Not Reporting on this Outcome Measure

Additional number of students gaining knowledge of heirloom variety characteristics.

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

- ◉ Change in Knowledge Outcome Measure
- ◯ Change in Action Outcome Measure
- ◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	10	0

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

- ☑ 202 - Plant Genetic Resources
- ☑ 205 - Plant Management Systems
- ☐ 301 - Reproductive Performance of Animals
- ☐ 302 - Nutrient Utilization in Animals
- ☐ 303 - Genetic Improvement of Animals
- ☐ 304 - Animal Genome
- ☐ 307 - Animal Management Systems
- ☐ 601 - Economics of Agricultural Production and Farm Management
- ☐ 604 - Marketing and Distribution Practices
- ☐ 610 - Domestic Policy Analysis

Outcome #4

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

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

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

- ◉ Change in Knowledge Outcome Measure
- ○ Change in Action Outcome Measure
- ○ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	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 to ascertain their genuineness. AFLP is a tool of choice since its reliability is based on two molecular techniques i.e., restriction digest and DNA amplification.

What has been done
Six tomato (Andrew Rahat Jumbo, Brandy Wine, Brimmer, Marizol Red, Russian & Tidwell German) and nine pepper (Anaheim, Cayenne, Cowhorn, Cubanelle, Habanera, Poblano Ancho, Red Bell, Serrano & Tabasco) heirloom varieties were analyzed using AFLP markers.

Results
To facilitate DNA-fingerprinting for true-to-type identification of heirloom tomato and pepper varieties automated DNA analysis system of Li-Cor (Lincoln, NE) was used. More than 300 molecular markers were produced to distinguish each tomato and pepper variety, using 20 dual-dye (IRD-800 and IRD-700) AFLP primer pairs.

4. Associated Knowledge Areas

- ☑ 202 - Plant Genetic Resources
- ☐ 205 - Plant Management Systems
- ☐ 301 - Reproductive Performance of Animals
- ☐ 302 - Nutrient Utilization in Animals
- ☐ 303 - Genetic Improvement of Animals
- ☐ 304 - Animal Genome
- ☐ 307 - Animal Management Systems
- ☐ 601 - Economics of Agricultural Production and Farm Management
- ☐ 604 - Marketing and Distribution Practices
- ☐ 610 - Domestic Policy Analysis

Outcome #5

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

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
- ( ) Change in Action Outcome Measure
- ( ) Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	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
One graduate student and two pre-college summer student interns were trained in the procedures of leaf sample collection, gel-electrophoresis, DNA extraction, AFLP analyses, Sequencing gel-analysis, and the use of bioinformatic tools for marker based genetic analyses.

Results
The pre-college (11th and 12th grade) student summer interns trained were inspired by the training received and showed their interest to choose TSU for college education. The 12th grader did join TSU and returned to PI's lab for undergraduate training.

4. Associated Knowledge Areas

- [x] 202 - Plant Genetic Resources
- [ ] 205 - Plant Management Systems
- [ ] 301 - Reproductive Performance of Animals
- [ ] 302 - Nutrient Utilization in Animals
- [ ] 303 - Genetic Improvement of Animals
- [ ] 304 - Animal Genome
- [ ] 307 - Animal Management Systems
- [ ] 601 - Economics of Agricultural Production and Farm Management
- [ ] 604 - Marketing and Distribution Practices
- [ ] 610 - Domestic Policy Analysis

Outcome #6

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

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

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

◉ Change in Knowledge Outcome Measure
◯ Change in Action Outcome Measure
◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	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
The six tomato (Andrew Rahat Jumbo, Brandy Wine, Brimmer, Marizol Red, Russian & Tidwell German) and nine pepper (Anaheim, Cayenne, Cowhorn, Cubanelle, Habanera, Poblano Ancho, Red Bell, Serrano & Tabasco) heirloom varieties were anlysed using AFLP markers.

Results
To facilitate DNA-fingerprinting for true-to-type identification of heirloom tomato and pepper varieties automated DNA analysis system of Li-Cor (Lincoln, NE) was used. More than 300 molecular markers were produced to distinguish each tomato and pepper variety, using 20 dual-dye (IRD-800 and IRD-700) AFLP primer pairs.

4. Associated Knowledge Areas

☑ 202 - Plant Genetic Resources
☐ 205 - Plant Management Systems
☐ 301 - Reproductive Performance of Animals
☐ 302 - Nutrient Utilization in Animals
☐ 303 - Genetic Improvement of Animals

- ☐ 304 - Animal Genome
- ☐ 307 - Animal Management Systems
- ☐ 601 - Economics of Agricultural Production and Farm Management
- ☐ 604 - Marketing and Distribution Practices
- ☐ 610 - Domestic Policy Analysis

Outcome #7

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

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
◯ Change in Action Outcome Measure
◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	1	0

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
Elements have not been identified yet.

Results
Elements have not been identified yet.

4. Associated Knowledge Areas

- ☑ 202 - Plant Genetic Resources
- ☐ 205 - Plant Management Systems
- ☐ 301 - Reproductive Performance of Animals
- ☐ 302 - Nutrient Utilization in Animals
- ☐ 303 - Genetic Improvement of Animals
- ☐ 304 - Animal Genome
- ☐ 307 - Animal Management Systems
- ☐ 601 - Economics of Agricultural Production and Farm Management
- ☐ 604 - Marketing and Distribution Practices
- ☐ 610 - Domestic Policy Analysis

Outcome #8

1. Outcome Measures

☑ Not Reporting on this Outcome Measure

Number of improved Goldenseal cultivars released.

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

○ Change in Knowledge Outcome Measure
◉ Change in Action Outcome Measure
○ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	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 11/2". the sizes of plants varied considerably.

4. Associated Knowledge Areas

- ☑ 202 - Plant Genetic Resources
- ☐ 205 - Plant Management Systems
- ☐ 301 - Reproductive Performance of Animals
- ☐ 302 - Nutrient Utilization in Animals
- ☐ 303 - Genetic Improvement of Animals
- ☐ 304 - Animal Genome
- ☐ 307 - Animal Management Systems
- ☐ 601 - Economics of Agricultural Production and Farm Management
- ☐ 604 - Marketing and Distribution Practices
- ☐ 610 - Domestic Policy Analysis

Outcome #9

1. Outcome Measures

☑ Not Reporting on this Outcome Measure

Number of techniques defined for improved Goldenseal production.

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

- ○ Change in Knowledge Outcome Measure
- ◉ Change in Action Outcome Measure
- ○ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	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

- ☑ 202 - Plant Genetic Resources
- ☐ 205 - Plant Management Systems
- ☐ 301 - Reproductive Performance of Animals
- ☐ 302 - Nutrient Utilization in Animals
- ☐ 303 - Genetic Improvement of Animals
- ☐ 304 - Animal Genome
- ☐ 307 - Animal Management Systems
- ☐ 601 - Economics of Agricultural Production and Farm Management
- ☐ 604 - Marketing and Distribution Practices
- ☐ 610 - Domestic Policy Analysis

Outcome #10

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

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

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

- ○ Change in Knowledge Outcome Measure
- ◉ Change in Action Outcome Measure
- ○ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	20	10

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

- ☐ 202 - Plant Genetic Resources
- ☐ 205 - Plant Management Systems
- ☐ 301 - Reproductive Performance of Animals
- ☐ 302 - Nutrient Utilization in Animals
- ☐ 303 - Genetic Improvement of Animals
- ☐ 304 - Animal Genome
- ☐ 307 - Animal Management Systems
- ☑ 601 - Economics of Agricultural Production and Farm Management
- ☐ 604 - Marketing and Distribution Practices
- ☑ 610 - Domestic Policy Analysis

Outcome #11

1. Outcome Measures

☑ Not Reporting on this Outcome Measure

Increase in number of producers with increased sales and income.

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

- ○ Change in Knowledge Outcome Measure
- ◉ Change in Action Outcome Measure
- ○ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	65	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Stakeholders will have interest if the number of producers and their incomes increase due to the associated benefits through the multiplier effect.

What has been done
Feedback was acquired from the state export development office regarding this issue.

Results
Change is slow due to lack of international marketing information and reluctance of producers willing to share information about international marketing and sales techniques.

4. Associated Knowledge Areas

- ☐ 202 - Plant Genetic Resources
- ☐ 205 - Plant Management Systems
- ☐ 301 - Reproductive Performance of Animals
- ☐ 302 - Nutrient Utilization in Animals
- ☐ 303 - Genetic Improvement of Animals
- ☐ 304 - Animal Genome
- ☐ 307 - Animal Management Systems
- ☐ 601 - Economics of Agricultural Production and Farm Management
- ☑ 604 - Marketing and Distribution Practices
- ☐ 610 - Domestic Policy Analysis

Outcome #12

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

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

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

- ○ Change in Knowledge Outcome Measure
- ◉ Change in Action Outcome Measure
- ○ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual

2010	75	75

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Access to relevant information that 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

- ☐ 202 - Plant Genetic Resources
- ☐ 205 - Plant Management Systems
- ☐ 301 - Reproductive Performance of Animals
- ☐ 302 - Nutrient Utilization in Animals
- ☐ 303 - Genetic Improvement of Animals
- ☐ 304 - Animal Genome
- ☐ 307 - Animal Management Systems
- ☑ 601 - Economics of Agricultural Production and Farm Management
- ☑ 604 - Marketing and Distribution Practices
- ☐ 610 - Domestic Policy Analysis

<u>Outcome #13</u>

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

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

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

◯ Change in Knowledge Outcome Measure
◉ Change in Action Outcome Measure
◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	50	50

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

☐ 202 - Plant Genetic Resources
☐ 205 - Plant Management Systems
☐ 301 - Reproductive Performance of Animals
☐ 302 - Nutrient Utilization in Animals
☐ 303 - Genetic Improvement of Animals
☐ 304 - Animal Genome
☐ 307 - Animal Management Systems
☑ 601 - Economics of Agricultural Production and Farm Management
☑ 604 - Marketing and Distribution Practices
☐ 610 - Domestic Policy Analysis

Outcome #14

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

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

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

◯ Change in Knowledge Outcome Measure
◉ Change in Action Outcome Measure
◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	100	100

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 a concern at the community, regional and national levels. 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 database 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

- ☐ 202 - Plant Genetic Resources
- ☐ 205 - Plant Management Systems
- ☐ 301 - Reproductive Performance of Animals
- ☐ 302 - Nutrient Utilization in Animals
- ☐ 303 - Genetic Improvement of Animals
- ☐ 304 - Animal Genome
- ☐ 307 - Animal Management Systems
- ☐ 601 - Economics of Agricultural Production and Farm Management
- ☑ 604 - Marketing and Distribution Practices
- ☐ 610 - Domestic Policy Analysis

Outcome #15

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

Increase in number of producers adopting alternative crop production.

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

- ○ Change in Knowledge Outcome Measure
- ◉ Change in Action Outcome Measure
- ○ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	15	10

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 alternative enterprises, 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

- ☐ 202 - Plant Genetic Resources
- ☐ 205 - Plant Management Systems
- ☐ 301 - Reproductive Performance of Animals
- ☐ 302 - Nutrient Utilization in Animals
- ☐ 303 - Genetic Improvement of Animals
- ☐ 304 - Animal Genome
- ☐ 307 - Animal Management Systems
- ☐ 601 - Economics of Agricultural Production and Farm Management
- ☑ 604 - Marketing and Distribution Practices
- ☐ 610 - Domestic Policy Analysis

Outcome #16

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

Increase in number of producers with increased farm diversification.

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

- ○ Change in Knowledge Outcome Measure
- ◉ Change in Action Outcome Measure
- ○ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	15	15

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Farm diversification is an important risk management tool. With increasing globalization and change in government regulations, diversification has become critical to avoid volatility in producer prices and crops.

What has been done
A number of alternative crops are considered, ranging from legumes such as pigeon pea to vegetables along with marketing channels.

Results
While the importance of diversification is recognized, transition requires producers to take risk to move to new crops and new enterprises. There is an aversion to risk that may be slow to change.

4. Associated Knowledge Areas

- ☐ 202 - Plant Genetic Resources
- ☐ 205 - Plant Management Systems
- ☐ 301 - Reproductive Performance of Animals
- ☐ 302 - Nutrient Utilization in Animals
- ☐ 303 - Genetic Improvement of Animals
- ☐ 304 - Animal Genome
- ☐ 307 - Animal Management Systems
- ☐ 601 - Economics of Agricultural Production and Farm Management
- ☑ 604 - Marketing and Distribution Practices
- ☐ 610 - Domestic Policy Analysis

Outcome #17

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

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

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

- ◉ Change in Knowledge Outcome Measure
- ◯ Change in Action Outcome Measure
- ◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	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
We are below our target number for this outcome. Large populations are required and since this is an ongoing effort more genes will be identified. Genes that may be responsible for excessive fat deposition were identified.

4. Associated Knowledge Areas

- ☐ 202 - Plant Genetic Resources
- ☐ 205 - Plant Management Systems
- ☐ 301 - Reproductive Performance of Animals
- ☑ 302 - Nutrient Utilization in Animals
- ☑ 303 - Genetic Improvement of Animals
- ☐ 304 - Animal Genome
- ☐ 307 - Animal Management Systems
- ☐ 601 - Economics of Agricultural Production and Farm Management
- ☐ 604 - Marketing and Distribution Practices
- ☐ 610 - Domestic Policy Analysis

Outcome #18

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

Number of alternative poultry birds examined in genetic resource population.

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

- ◉ Change in Knowledge Outcome Measure
- ◯ Change in Action Outcome Measure
- ◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual

2010	200	120

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
Target was not met due to mortality. This efforts will be continued since large populations will be required to identify adipose specific genes.

4. Associated Knowledge Areas

- ☐ 202 - Plant Genetic Resources
- ☐ 205 - Plant Management Systems
- ☐ 301 - Reproductive Performance of Animals
- ☐ 302 - Nutrient Utilization in Animals
- ☐ 303 - Genetic Improvement of Animals
- ☑ 304 - Animal Genome
- ☐ 307 - Animal Management Systems
- ☐ 601 - Economics of Agricultural Production and Farm Management
- ☐ 604 - Marketing and Distribution Practices
- ☐ 610 - Domestic Policy Analysis

Outcome #19

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

Number of meat goats screened for genetic markers.

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

- ◉ Change in Knowledge Outcome Measure
- ◯ Change in Action Outcome Measure
- ◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	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
This research has been temporally suspended due to historic flooding this spring that wiped out the herds.

Results
This research has been temporally suspended due to historic flooding this spring that wiped out the herds.

4. Associated Knowledge Areas

- ☐ 202 - Plant Genetic Resources
- ☐ 205 - Plant Management Systems
- ☐ 301 - Reproductive Performance of Animals
- ☐ 302 - Nutrient Utilization in Animals
- ☑ 303 - Genetic Improvement of Animals
- ☑ 304 - Animal Genome
- ☐ 307 - Animal Management Systems
- ☐ 601 - Economics of Agricultural Production and Farm Management
- ☐ 604 - Marketing and Distribution Practices
- ☐ 610 - Domestic Policy Analysis

Outcome #20

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

Percentage of Guinea fowl producers realizing savings in feeding costs.

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

- ○ Change in Knowledge Outcome Measure
- ○ Change in Action Outcome Measure
- ◉ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	50	75

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The costs associated with the production of Guinea fowl need to minimized for producers to realize maximum profit as this species becomes more accepted in American diets.

What has been done
Requirement 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
Findings were communicated through publication and directly to guinea fowl breeders association (GFBA). We are not able to definitively quantify the number of producers reached through print media, but GFBA comprises over 25% of producers.

4. Associated Knowledge Areas

- ☐ 202 - Plant Genetic Resources
- ☐ 205 - Plant Management Systems
- ☐ 301 - Reproductive Performance of Animals
- ☐ 302 - Nutrient Utilization in Animals
- ☐ 303 - Genetic Improvement of Animals
- ☐ 304 - Animal Genome
- ☑ 307 - Animal Management Systems
- ☐ 601 - Economics of Agricultural Production and Farm Management
- ☐ 604 - Marketing and Distribution Practices
- ☐ 610 - Domestic Policy Analysis

<u>Outcome #21</u>

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

Percentage of producers implementing recommendations for optimized Guinea fowl production.

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

○ Change in Knowledge Outcome Measure
○ Change in Action Outcome Measure
◉ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	90	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

☐ 202 - Plant Genetic Resources
☐ 205 - Plant Management Systems
☐ 301 - Reproductive Performance of Animals
☑ 302 - Nutrient Utilization in Animals
☐ 303 - Genetic Improvement of Animals
☐ 304 - Animal Genome
☑ 307 - Animal Management Systems
☐ 601 - Economics of Agricultural Production and Farm Management
☐ 604 - Marketing and Distribution Practices
☐ 610 - Domestic Policy Analysis

Outcome #22

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

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

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

○ Change in Knowledge Outcome Measure
○ Change in Action Outcome Measure
◉ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	80	25

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
Cannot verify those reached by print and online publications, but research findings were communicated to the Guinea Fowl Breeders Association constituting more than 25% of guinea fowl producers. Assessment of profitability has not been completed yet.

4. Associated Knowledge Areas

☐ 202 - Plant Genetic Resources
☐ 205 - Plant Management Systems
☐ 301 - Reproductive Performance of Animals
☑ 302 - Nutrient Utilization in Animals
☐ 303 - Genetic Improvement of Animals
☐ 304 - Animal Genome
☑ 307 - Animal Management Systems

- ☐ 601 - Economics of Agricultural Production and Farm Management
- ☐ 604 - Marketing and Distribution Practices
- ☐ 610 - Domestic Policy Analysis

V(H). Planned Program (External Factors)

External factors which affected outcomes

- ☑ Natural Disasters (drought, weather extremes, etc.)
- ☐ Economy
- ☑ Appropriations changes
- ☐ Public Policy changes
- ☐ Government Regulations
- ☐ Competing Public priorities
- ☑ Competing Programmatic Challenges
- ☑ Populations changes (immigration, new cultural groupings, etc.)
- ☑ Other (Floods)

Brief Explanation

Much of the animal research was affected either directly or indirectly by the historic floods that occurred in metropolitan Nashville during the spring of 2010. The goat programs were particularly hard-hit, with hundreds of goats being lost. Other service interruptions affected other research programs as well.

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

(OPTIONAL SECTION)

1. Evaluation Studies Planned

- ☐ After Only (post program)
- ☐ Retrospective (post program)
- ☐ Before-After (before and after program)
- ☐ During (during program)
- ☐ Time series (multiple points before and after program)
- ☐ Case Study
- ☐ 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.
- ☐ Comparison between locales where the program operates and sites without program intervention
- ☐ Other

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

Global Food Security and Hunger -Molecular approaches for the study of microorganisms in 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
212	Pathogens and Nematodes Affecting Plants				100%
	Total				100%

Add knowledge area

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	2.5
Actual	0.0	0.0	0.0	4.8

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	105427
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	0	100114
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	139843

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. 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 in 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

2010	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: 2010
Plan: 0
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Plan	0	1	
Actual	0	2	2

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Scientific publications relating to plant/leaf microbe interactions

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	1	2

Output #2

Output Measure

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

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	0	0

Output #3

Output Measure

- Number of pertinent bacterial strains identified

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	0	20

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

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

Add Cross-cutting Outcome/Impact Statement or Unintended or Previously Unknown Outcome Measure

Outcome #1

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

Number of potential biocontrol candidates identified

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

◉ Change in Knowledge Outcome Measure
◯ Change in Action Outcome Measure
◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	20

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
To date, 20 potential candidates have been identified and are being characterized.

4. Associated Knowledge Areas

☑ 212 - Pathogens and Nematodes Affecting Plants

Outcome #2

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

Number of crops with blocked epiphyte-pathogen switch identified

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

○ Change in Knowledge Outcome Measure
○ Change in Action Outcome Measure
◉ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	1	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Leaf surface pathogens are still an important group of pathogens in the US agriculture today. Therefore all farmers are directly or indirectly concerned by these pathogens.

What has been done
The isolates were characterized to determine their identity and potential for use in efficacy testing against common epiphytic and other foliar pathogens.

Results
Unfortunately, a more complete level of understanding of the switch needs to be determined before this target can be met. Our target for this stage of the project was overly ambitions.

4. Associated Knowledge Areas

☑ 212 - Pathogens and Nematodes Affecting Plants

V(H). Planned Program (External Factors)

External factors which affected outcomes

☑ Natural Disasters (drought, weather extremes, etc.)
☐ Economy
☑ Appropriations changes
☑ Public Policy changes
☑ Government Regulations
☐ Competing Public priorities
☐ Competing Programmatic Challenges
☐ Populations changes (immigration, new cultural groupings, etc.)
☑ Other (See below.)

Brief Explanation

Elucidation of the epiphyte-pathogen switch has proven to be more problematic that anticipated. Additional experimental and conformational steps are required to before a definite conclusion can be determined.

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

(OPTIONAL SECTION)

1. Evaluation Studies Planned

- ☐ After Only (post program)
- ☐ Retrospective (post program)
- ☐ Before-After (before and after program)
- ☑ During (during program)
- ☑ Time series (multiple points before and after program)
- ☐ Case Study
- ☐ 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.
- ☐ Comparison between locales where the program operates and sites without program intervention
- ☐ Other

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

Childhood Obesity -Improving families through better nutrition and enhanced 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				25%
704	Nutrition and Hunger in the Population				25%
724	Healthy Lifestyle				25%
801	Individual and Family Resource Management				25%
	Total				100%

Add knowledge area

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	3.4
Actual	0.0	0.0	0.0	6.1

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	133980
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	0	127228
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	177717

V(D). Planned Program (Activity)

1. Brief description of the Activity

A program was developed and activities designed to educate adults and children in a long-term healthy living lifestyle. Participants were 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

2010	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: 2010
Plan: 0
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Plan	0	1	
Actual	0	1	1

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.

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	1	1

Output #2

Output Measure

- Development of complete set of games for project use

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	0	0

Output #3

Output Measure

- Development of healthy mini-camp curricula

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	1	1

Output #4

Output Measure

- Development of complete set of online lessons for parents

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	1	0

Output #5

Output Measure

- Development of newsletters for families.

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	0	0

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

Add Cross-cutting Outcome/Impact Statement or Unintended or Previously Unknown Outcome Measure

Outcome #1

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

Percentage of participants with increased nutrition knowledge

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

◉ Change in Knowledge Outcome Measure
◯ Change in Action Outcome Measure
◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	25	94

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 mini-camp for parents was held. Parents were interviewed at the beginning and end of the camp to determine increased knowledge. Exhibits at local farmer's markets were used to teach about the importance of water and eating fruits and vegetables.

Results
Half of the parents indicated that they learned something new that they could apply at home at the mini-camp. All participants at the farmers market exhibits said they learned something new and wanted the exhibits to be continued each week.
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.

4. Associated Knowledge Areas

☑ 703 - Nutrition Education and Behavior
☐ 704 - Nutrition and Hunger in the Population

- ☑ 724 - Healthy Lifestyle
- ☐ 801 - Individual and Family Resource Management

Outcome #2

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

Percentage of participants with improved reported behaviors

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

- ○ Change in Knowledge Outcome Measure
- ◉ Change in Action Outcome Measure
- ○ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	12	0

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
This quantification of the research was not conducted this year.

Results
This quantification of the research was not conducted this year.

4. Associated Knowledge Areas

- ☑ 703 - Nutrition Education and Behavior
- ☐ 704 - Nutrition and Hunger in the Population
- ☑ 724 - Healthy Lifestyle
- ☐ 801 - Individual and Family Resource Management

Outcome #3

1. Outcome Measures

☑ Not Reporting on this Outcome Measure

Quarterly percent increase in participation points

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

◯ Change in Knowledge Outcome Measure
◉ Change in Action Outcome Measure
◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	3	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

☑ 703 - Nutrition Education and Behavior
☐ 704 - Nutrition and Hunger in the Population
☑ 724 - Healthy Lifestyle
☐ 801 - Individual and Family Resource Management

Outcome #4

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

Annual percent increase in number of males participating

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

◯ Change in Knowledge Outcome Measure
◉ Change in Action Outcome Measure
◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	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
A day camp was held for parents. Only one male attended out of the 15 participants. However exhibits at farmer's markets were well-attended by both males and females. It appears that males are easier to reach when not confined to a space and a schedule.
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
Additional research needs to be performed to determine techniques to increase male participation.

4. Associated Knowledge Areas

☑ 703 - Nutrition Education and Behavior
☐ 704 - Nutrition and Hunger in the Population
☑ 724 - Healthy Lifestyle
☐ 801 - Individual and Family Resource Management

Outcome #5

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

Percentage decrease in school absenteeism

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

◯ Change in Knowledge Outcome Measure
◯ Change in Action Outcome Measure
◉ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	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
We are still trying to access data on attendance records and weight data from Head Start. The collaborator for this project left the organization, since then there are unexpected interpretations of privacy concerns hampering data collection.

Results
No results to date.

4. Associated Knowledge Areas

☑ 703 - Nutrition Education and Behavior
☐ 704 - Nutrition and Hunger in the Population
☑ 724 - Healthy Lifestyle
☐ 801 - Individual and Family Resource Management

V(H). Planned Program (External Factors)

External factors which affected outcomes

- ☑ Natural Disasters (drought, weather extremes, etc.)
- ☐ Economy
- ☐ Appropriations changes
- ☐ Public Policy changes
- ☐ Government Regulations
- ☐ Competing Public priorities
- ☐ Competing Programmatic Challenges
- ☑ Populations changes (immigration, new cultural groupings, etc.)
- ☑ Other (See below.)

Brief Explanation

This project has highlighted the multi-faceted difficulties in getting males to participate in family education programs. Also, staff turnover in collaborator organization has proven to be an unexpected impediment to other portions of the project.

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

(OPTIONAL SECTION)

1. Evaluation Studies Planned

- ☐ After Only (post program)
- ☐ Retrospective (post program)
- ☑ Before-After (before and after program)
- ☑ During (during program)
- ☐ Time series (multiple points before and after program)
- ☐ Case Study
- ☐ 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.
- ☐ Comparison between locales where the program operates and sites without program intervention
- ☐ Other

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

Global Food Security and Hunger - Monitor and mitigate environmental impacts of agriculture.

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%

Add knowledge area

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	2.6
Actual	0.0	0.0	0.0	4.9

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	107624
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	0	102199
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	142757

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

2010	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: 2010
Plan: 0
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Plan	0	1	
Actual	0	1	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

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

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	1	1

Output #2

Output Measure

- Development of water quality analysis techniques

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	1	1

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

Add Cross-cutting Outcome/Impact Statement or Unintended or Previously Unknown Outcome Measure

Outcome #1

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

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

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

◯ Change in Knowledge Outcome Measure
◉ Change in Action Outcome Measure
◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	10	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
During storm events, large volume of sediments can be added to creeks from surface runoff, especially in field plots where the landscape has been disturbed (plowed or disked). Nursery crop growers are not aware of the impact these management practices have on surface water. As a result of this issue, water managers and residents that live in the Collins River sub-watershed and the State regulatory agency (Tennessee Department of Environment & Conservation, TDEC) care because plowing, liming and fertilization of nursery fields can result in the runoff of tons of soil and essential crop nutrient such as phosphorus to inflow creeks (tributaries) of the Collins River. Phosphorus, metals and many organics adsorb to fine silt and clay. Fine silt and clay are some component of sediments.

What has been done
An inventory of nursery operations at the Collins River sub-watershed was conducted. Two major tributaries (Mountain creek and Hills Creek) of the Collins River were identified based on the large numbers of nursery crop fields in the proximity of the creeks. A third creek with no nursery crop fields in the proximity was also identified. The three creeks will be sampled in the spring of 2011 for eight consecutive weeks for analysis of ortho-phosphorous , calcium, magnesium and potassium. The creeks will also be sampled for the following water quality parameters: turbidly (because of the strong correlation between turbidity and sediment), specific conductance, total dissolved solids, dissolved oxygen, pH and temperature.

Results
The inventory of nursery operations at the sub-watershed provided baseline information on the nature of farm operations, fertilizer and lime management practices, and tillage practices performed by growers in the Collins River sub-watershed. The majority of the nursery plants were

grown in fields (about 90 %) and about 10 % were grown in containers in green houses. While the water demand for the field operation was met by rainfall, the container-grown crops were under some form of irrigation practice(s). The fields are usually disked prior to planting of the seedling stock. Most growers in sub-watershed do not apply fertilizer or lime annually, partly because majority of the nursery crops are perennials. It is too soon to report the results of the water quality monitoring of the creeks.

4. Associated Knowledge Areas

☑ 112 - Watershed Protection and Management

Outcome #2

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

Number of water bodies removed from 303(d) list

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

○ Change in Knowledge Outcome Measure
○ Change in Action Outcome Measure
◉ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Soil sediment is a major pollutant of surface water on a volume basis. The muddying of creeks reduces their value for both home, industrial and recreational use, as well as fishing. The Collins River is a major source of public water supply and recreational source for the residents of the Collins River sub-watershed. The Collins River watershed drains four rural counties in Middle Tennessee. The river is listed in Tennessee's 303(d) list of impaired water body mostly due to sediment enrichment. As a result, the state regulatory agency (TDEC) is concerned about this river. In the long run, TDEC would like to see the Collins River removed from the 303(d) list

What has been done
Two major inflow creeks of the Collins River will be monitored in 2011 and 2012 for their water quality including sediment as a function of the creeks' turbidity concentration.

Results

It is too soon for the results of the monitoring efforts to be reported.

4. Associated Knowledge Areas

☑ 112 - Watershed Protection and Management

Outcome #3

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

Number of agricultural producers per year developing a nutrient management plan

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

○ Change in Knowledge Outcome Measure
◉ Change in Action Outcome Measure
○ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	2	0

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), has concerns 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.
Growers have been informed of the concept of developing nutrient management plan for their field operation.

Results
There are an increasing number of growers who are 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. We have not be able to ascertain how many have developed a management plan.

4. Associated Knowledge Areas

☑ 112 - Watershed Protection and Management

Outcome #4

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

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
◯ Change in Action Outcome Measure
◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	2	3

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
Three students (one graduate student and two undergraduate students) hired as student workers are involved in the project and gaining both research and extension experiential training.

Results
The students are assisting in instrument calibration and method development for analyses stream water quality.

4. Associated Knowledge Areas

☑ 112 - Watershed Protection and Management

V(H). Planned Program (External Factors)

External factors which affected outcomes

- ☑ Natural Disasters (drought, weather extremes, etc.)
- ☐ Economy
- ☑ Appropriations changes
- ☐ Public Policy changes
- ☑ Government Regulations
- ☐ Competing Public priorities
- ☑ Competing Programmatic Challenges
- ☐ Populations changes (immigration, new cultural groupings, etc.)
- ☐ Other

Brief Explanation

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

(OPTIONAL SECTION)

1. Evaluation Studies Planned

- ☐ After Only (post program)
- ☐ Retrospective (post program)
- ☑ Before-After (before and after program)
- ☑ During (during program)
- ☐ Time series (multiple points before and after program)
- ☐ Case Study
- ☑ 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.
- ☐ Comparison between locales where the program operates and sites without program intervention
- ☐ Other

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

Global Food Security and Hunger- Improving agricultural plants through reduced response to stress.

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

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

Add knowledge area

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	4.0
Actual	0.0	0.0	0.0	7.0

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	153748
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	0	145999
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	203938

V(D). Planned Program (Activity)

1. Brief description of the Activity

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

2. Brief description of the target audience

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

V(E). Planned Program (Outputs)

1. Standard output measures

2010	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: 2010
Plan: 0
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Plan	0	2	
Actual	0	2	0

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.

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	2	2

Output #2

Output Measure

- Scientific publications concerning reduced response to stress.

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	2	2

Output #3

Output Measure

- Patents for temperature stress genes.

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	0	0

Output #4

Output Measure

- Temperature stress tolerant plant cultivars.

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	1	0

Output #5

Output Measure

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

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	1	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.
5	Temperature stress tolerance genes identified.
6	Temperature stress tolerant plant cultivars developed.

Add Cross-cutting Outcome/Impact Statement or Unintended or Previously Unknown Outcome Measure

Outcome #1

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

Number of integrated stress management and disease prevention strategies developed.

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

○ Change in Knowledge Outcome Measure
◉ Change in Action Outcome Measure
○ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	1	0

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 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
To determine if the host stress proteome is recruited by pathogens for aiding in their survival to inflict aggressive infectivity, plant extracts from stressed and unstressed potato cultures (heat resistant and sensitive) were assayed for inducing bacterial enzyme pectate lyases (Pel) activity from two soft-rot mutants (high and low virulence). Also non-pathogen specific heat shock proteins (HSPs) were introduced for Pel assays to quantify if soft-rot bacterial activity increased.

Results
The correlation of high stress with increased infection was substantiated as the extracts from the Atlantic potatoes appeared more prone to infection by showing higher Pel activity compared to that of heat-resistant Norchip host. Furthermore the role of host HSPs in bacterial proliferation was observed when mixture of HSPs used caused higher Pel activity in comparison to the assays when unstressed plant extracts or no HSPs mixture were used.

4. Associated Knowledge Areas

☐ 201 - Plant Genome, Genetics, and Genetic Mechanisms
☑ 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

☐ Not Reporting on this Outcome Measure

Number of molecular mechanisms for plant stress identified.

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

◉ Change in Knowledge Outcome Measure
◯ Change in Action Outcome Measure
◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	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
Pel activity from the soft rot bacteria were measured in the presence or absence of extracts from heat-tolerant Norchip plants. The plant extracts were prepared from unstressed and potatoes subjected to 16 hour heat stress. Therefore, six experimental conditions were tested to ascertain that the diseases and plant host stress proteins can cohort for enhancing severity of infections.

Results
Subjected to 16 hour heat-stress, the plant extracts from cold-climate potato variety Atlantic produced significantly more Pel activity from the soft rot bacteria compared to when extracts from heat-tolerant Norchip plants or no extract were used. Since some small molecular sized HSPs remained stable for up to 18 hours in heat-sensitive Atlantic compared to 12 hours in heat-tolerant Norchip, such and similar host heat-shock-proteins may be recruited by pathogens for relatively more aggressive infection on heat-sensitive varieties.

4. Associated Knowledge Areas

- ☐ 201 - Plant Genome, Genetics, and Genetic Mechanisms
- ☑ 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

☐ Not Reporting on this Outcome Measure

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
◯ Change in Action Outcome Measure
◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	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 to provide training to minority students in the advanced field of plant biotechnology.

What has been done
This project has contributed to the training of graduate and pre-college students in microbial and plant molecular biology techniques

Results
This project resulted in the M.S. thesis completion of one graduate student in agricultural sciences. Two pre-college summer student interns were trained in microbial and plant molecular biology techniques while other graduate students in the department were exposed to methods and outcomes of this project.

4. Associated Knowledge Areas

☐ 201 - Plant Genome, Genetics, and Genetic Mechanisms

- ☑ 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

☐ Not Reporting on this Outcome Measure

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
◯ Change in Action Outcome Measure
◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	40	50

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
The research findings of this project were disseminated though print media as well as orally to stakeholders.

Results
The graduate thesis describing the finding of this project was defended in front of faculty members and students. The printed thesis is now available though electronic means and TSU library use. In excess of 50 stakeholders have been reached by publishing the research results in the proceedings of Southern Nursery Association Research Conference.

4. Associated Knowledge Areas

- ☐ 201 - Plant Genome, Genetics, and Genetic Mechanisms
- ☑ 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants

- ☑ 212 - Pathogens and Nematodes Affecting Plants
- ☑ 216 - Integrated Pest Management Systems

Outcome #5

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

Temperature stress tolerance genes identified.

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

◉ Change in Knowledge Outcome Measure
◯ Change in Action Outcome Measure
◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	1	1

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
A cold tolerance gene isolated from Helloborus plants was characterized.

Results
The cold-hardiness gene has been isolated and submitted to appropriate databases. Efforts are underway for transformation of tomato and subsequent evaluation of transgenic plants. One graduate student has been trained in tomato transformation techniques.

4. Associated Knowledge Areas

- ☑ 201 - Plant Genome, Genetics, and Genetic Mechanisms
- ☐ 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- ☐ 212 - Pathogens and Nematodes Affecting Plants
- ☐ 216 - Integrated Pest Management Systems

Outcome #6

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

Temperature stress tolerant plant cultivars developed.

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

◯ Change in Knowledge Outcome Measure
◉ Change in Action Outcome Measure
◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	1	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 tomato over expressing the glycolate oxidase gene were selected and tested for stress resistance in the greenhouse in 2010.

Results
Transgenic plants showed some phenotypic changes in floral organ development, but did not improve tolerance to cold stress. Due to unexpected insect infestations evaluations of transgenic plants could not be completed as planned in 2010. These plants will be re-evaluated in 2011.

4. Associated Knowledge Areas

☑ 201 - Plant Genome, Genetics, and Genetic Mechanisms
☐ 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
- ☐ Appropriations changes
- ☑ Public Policy changes
- ☐ Government Regulations
- ☐ Competing Public priorities
- ☑ Competing Programmatic Challenges
- ☐ Populations changes (immigration, new cultural groupings, etc.)
- ☐ Other

Brief Explanation

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

(OPTIONAL SECTION)

1. Evaluation Studies Planned

- ☐ After Only (post program)
- ☐ Retrospective (post program)
- ☑ Before-After (before and after program)
- ☑ During (during program)
- ☐ Time series (multiple points before and after program)
- ☐ Case Study
- ☑ 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.
- ☐ Comparison between locales where the program operates and sites without program intervention
- ☐ Other

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

Food Safety - Research to mitigate food-borne illness.

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

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

Add knowledge area

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	4.3
Actual	0.0	0.0	0.0	7.5

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	164730
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	156428
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	218505

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. Obtain data on the prevalence and types of antibiotic resistant microorganisms isolated from fresh produce. Develop strategies to minimize potential for food borne illness originating from improper food handling and animal management practices. Conduct laboratory experiments to develop a biosensor. Conduct field trials to evaluate the biosensor. Transfer the developed technology to end users.
Design a survey for collecting primary information from consumers, small producers and selected food handlers. Design training/education strategies and materials. Construct and review sound experimental design for the study and explore analytical and statistical method(s) for analyzing data. 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 processors, packaged foods industry, agricultural producers and alternative meat and poultry producers, consumers, risk assessment agencies, food scientists.

V(E). Planned Program (Outputs)

1. Standard output measures

2010	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: 2010
Plan: 0
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Plan	0	3	
Actual	0	3	3

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.

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	1	1

Output #2

Output Measure

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

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	1	1

Output #3

Output Measure

- Profiles of antibiotic resistance in fresh produce determined.

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	1	1

Output #4

Output Measure

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

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	0	1

Output #5

Output Measure

- Publications relating to rapid detection of Salmonella in foods.

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	1	1

Output #6

Output Measure

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

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	1	1

Output #7

Output Measure

- Consumer education materials in food handling practices

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	10	10

Output #8

Output Measure

- Microbial profile of meat goat carcasses

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	1	0

Output #9

Output Measure

- Microbial profile of guinea fowl carcasses

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	1	1

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.
3	New technologies developed to detect Salmonella in foods.
4	Transfer of new Salmonella detection procedures to commercial food industry.
5	Number of people with increased knowledge of sources, estimated cost and recommendations concerning food borne illness in Tennessee.
6	Number of consumers applying knowledge from education and training.
7	Number of small producers applying knowledge from education and training.
8	Percentage of producers that will change production practices to reduce contamination of meat goat and guinea fowl
9	Percentage of targeted consumers that will be following best management practices for reducing microbial contamination.

Add Cross-cutting Outcome/Impact Statement or Unintended or Previously Unknown Outcome Measure

Outcome #1

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

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
◯ Change in Action Outcome Measure
◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	10	9

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
Data concerning antibiotic-resistant foodborne pathogens on fresh produce have been collected. Questionnaires have been developed to collect data on consumers' fresh produce handling practices before and after food safety education.

Results
9% of selected consumers have been trained on safe ways of handling fresh produce.

4. Associated Knowledge Areas

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

Outcome #2

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

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 Knowledge Outcome Measure
◉ Change in Action Outcome Measure
◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	30	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 carries 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 laboratory results, educational materials are being designed to educate the farmers on avoiding planting crops on land prone to flooding or in areas where irrigation water may be in contact with animal feed lots, and avoiding application of animal manure on the fields within 120 days of harvesting. Growers are also being informed of the practicality of testing irrigation water before application.

Results
Farmers have not yet been educated. We are in the process of collecting data on the usage of antibiotics on farms. The data collected will be used to develop educational materials.

4. Associated Knowledge Areas

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

Outcome #3

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

New technologies developed to detect Salmonella in foods.

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

- ○ Change in Knowledge Outcome Measure
- ◉ Change in Action Outcome Measure
- ○ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	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
A Surface Plasmon Resonance (SPR) sensor for simultaneous detection of Salmonella typhimurium and Campylobacter jejuni in chicken rinse water without culture enrichment was developed using monoclonal antibodies (MAbs) against flagellar antigens.
A three-channel SPR sensor was configured, each with individual fluid control system. The sensor immobilization scheme consisted of depositing a layer of neutravidin to the gold surface, followed by introducing biotinylated MAbs specific to S. typhimurium and C. jejuni into separate channels and a non-specific MAb into the third channel as a reference. An analytical protocol including glycine-hydrochloride extraction, centrifugation and gel filtration was developed in conjunction with SPR analysis.

Results
By eliminating enrichment procedures which normally require 8-16 hr incubation time, the developed protocol can be performed in less than 1 hr. The sensor specifically detected S. typhimurium and C. jejuni in the coexistence of non-pathogenic E. coli.

4. Associated Knowledge Areas

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

Outcome #4

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

Transfer of new Salmonella detection procedures to commercial food industry.

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

- ○ Change in Knowledge Outcome Measure
- ○ Change in Action Outcome Measure
- ◉ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	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 contamination.

What has been done
A fast and sensitive analysis for simultaneous detection of S. typhimurium and C. jejuni in chicken rinse water without culture enrichment has been developed. The detection methodology was introduced to meat industry professional at the Annual Meeting of Institute of Food Technologists.

Results
The developed sensor analysis, which requires minimal investment in instrumentation and requires fewer labor inputs than other molecular methods has potential applications in poultry processing plants.

4. Associated Knowledge Areas

- ☐ 504 - Home and Commercial Food Service
- ☐ 602 - Business Management, Finance, and Taxation

☑ 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and

Outcome #5

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

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

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

◉ Change in Knowledge Outcome Measure
◯ Change in Action Outcome Measure
◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	50	350

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Food safety has become increasingly important in the U.S. About 76 million people become ill from consuming unsafe food, of this total, 325,000 are hospitalized and 5,000 die. An accurate count of the number of people consuming unsafe food is difficult to estimate. National averages 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.
Students were recruited, mentored and taught in conducting scientific research, computers, data collection, processing and analyzing. Faculty and students were trained in Excel, Power Point, Statistical Package for the Social Sciences (SPSS) enabling them to apply skills in development of flyers, papers, posters and theses. Six presentations on food safety were made with about 235 individuals at the Food Distribution Research Society Annual meeting in Broomfield, CO (75); Tuskegee University, AL (60); TSU Nursery Crop Research Center, TN (35), TSU Bi-monthly Research Seminars (35) and the student summer apprentices program (30).
Established data for used by students, faculty and researchers interested in developing thesis, papers, poster and addressing food safety. Project shared information that can be used to reduce cost and minimize common Foodborne illnesses (such as microbial, pathogens, bacteria and cross contamination to avoid E coli and Salmonella in their foods).

Results

Information collected showed that food safety is still of great concern to Tennesseans. While 66.7% of the respondent considered the issue of food safety very important. Respondents were most concerned with becoming sick from eating unsafe foods, keeping food safe, good hygiene by food handlers, contamination of food from E coli and other bacteria. Subsequently, 68.6 % said they were interested in food safety training. Thirty-six percent of respondent did not think that food service and restaurant workers received adequate training in Tennessee. Approximately 60 % of respondents worked in restaurant businesses, responsible for cooking, serving, keeping kitchen and dining areas clean.

4. Associated Knowledge Areas

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

Outcome #6

1. Outcome Measures

☑ Not Reporting on this Outcome Measure

Number of consumers applying knowledge from education and training.

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

- ○ Change in Knowledge Outcome Measure
- ◉ Change in Action Outcome Measure
- ○ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	50	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

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

Outcome #7

1. Outcome Measures

☑ Not Reporting on this Outcome Measure

Number of small producers applying knowledge from education and training.

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

- ○ Change in Knowledge Outcome Measure
- ◉ Change in Action Outcome Measure
- ○ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	25	0

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

☑ 504 - Home and Commercial Food Service

- ☑ 602 - Business Management, Finance, and Taxation
- ☑ 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and

Outcome #8

1. Outcome Measures

☑ Not Reporting on this Outcome Measure

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

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

- ◉ Change in Knowledge Outcome Measure
- ◯ Change in Action Outcome Measure
- ◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	15	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

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

Outcome #9

1. Outcome Measures

☑ Not Reporting on this Outcome Measure

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 Knowledge Outcome Measure
◉ Change in Action Outcome Measure
◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	20	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

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

V(H). Planned Program (External Factors)

External factors which affected outcomes

☐ Natural Disasters (drought, weather extremes, etc.)
☐ Economy
☑ Appropriations changes
☐ Public Policy changes
☑ Government Regulations
☐ Competing Public priorities
☑ Competing Programmatic Challenges
☐ Populations changes (immigration, new cultural groupings, etc.)
☑ Other (See below)

Brief Explanation

Unmet goals in this project are due to the unexpected incapacitation of a key investigator on the project. Steps are being made to re-assign duties of the investigator.

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

(OPTIONAL SECTION)

1. Evaluation Studies Planned

- ☐ After Only (post program)
- ☐ Retrospective (post program)
- ☑ Before-After (before and after program)
- ☑ During (during program)
- ☐ Time series (multiple points before and after program)
- ☐ Case Study
- ☑ 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.
- ☐ Comparison between locales where the program operates and sites without program intervention
- ☐ Other

Evaluation Results

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Global Food Security and Hunger - Reducing plant pest problems using environmentally sound methods.

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

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

Add knowledge area

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	14.4
Actual	0.0	0.0	0.0	16.7

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	366799
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	348312
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	486538

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research experiments with approved and experimental insecticide compounds will be conducted that
will lead to new or improved fire ant and Japanese beetle quarantine treatments for field nursery plants. The research will expand grower options in the Federal Imported Fire Ant Quarantine and the U.S. Domestic Japanese Beetle Harmonization Plan. The TSU Entomology Program will partner with USDA/ARS and USDA-APHIS collaborators to achieve these outcomes. This program will also perform research to identify powdery mildew resistance, resistance to cercospora leafspot/blight, and to identify and catalog soil-borne pathogens prevalent in the Tennessee nursery industry.
Additionally, new biopesticide compounds that can manage soil-borne pathogen and insect problems in container nurseries will be developed. The research will be used to expand grower options and offer alternatives that are safer for farm labor and the environment. In addition to finding and developing alternative pest management options, we intend to demonstrate that a significant reduction in offsite environmental contamination can be accomplished by grower adoption of biopesticide pest management options.

2. 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, agricultural research community, Extension agents, parks, schools.

V(E). Planned Program (Outputs)

1. Standard output measures

2010	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: 2010
Plan: 0
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Plan	0	3	
Actual	0	5	5

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

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

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	3	5

Output #2

Output Measure

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

☐ Not reporting on this Output for this Annual Report

Year	Target	Actual
2010	0	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 program issues.
2	Percentage of nurseries adopting fire ant control strategies using newly discovered chemicals.
3	Number of educational trade articles to increase grower awareness.
4	Development of an improved treatment method for Japanese beetle and imported fire ant.
5	Approval of new insecticides or lower rates of existing insecticides in Fire Ant and Japanese Beetle quarantines.
6	Increase in number of growers aware of newly identified disease resistant cultivars
7	Increase in number of growers aware of causes of disease and pathogen survival
8	Increase in number of growers aware of soil-borne disease prevention methods
9	Increase in number of Tennessee growers aware of disease resistant hydrangea cultivars
10	Number of new biopesticde treatments developed
11	Percent reduction in pesticide movement offsite of research facility

Add Cross-cutting Outcome/Impact Statement or Unintended or Previously Unknown Outcome Measure

Outcome #1

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

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

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

◉ Change in Knowledge Outcome Measure
◯ Change in Action Outcome Measure
◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	150	200

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
Presentations concerning fire ant and other invasive insect introductions and control strategies were made at field days, open houses and stakeholder conference.

Results
Nursery producers in the region are much more aware of the problems associated with inadvertent movement of invasive insects.

4. Associated Knowledge Areas

☑ 133 - Pollution Prevention and Mitigation
☑ 211 - Insects, Mites, and Other Arthropods Affecting Plants
☐ 212 - Pathogens and Nematodes Affecting Plants
☐ 215 - Biological Control of Pests Affecting Plants

Outcome #2

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

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

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

◯ Change in Knowledge Outcome Measure
◉ Change in Action Outcome Measure
◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	5	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
Laboratory-based analysis of a number of essential oils and other plant extracts have been completed. Field testing has been constrained by an overall decrease in available test sites due to colder-than-average winter.

Results
Alternative treatments have not been introduced due to lack of field-level data to present for approval by regulatory agencies.

4. Associated Knowledge Areas

☐ 133 - Pollution Prevention and Mitigation
☑ 211 - Insects, Mites, and Other Arthropods Affecting Plants
☐ 212 - Pathogens and Nematodes Affecting Plants
☐ 215 - Biological Control of Pests Affecting Plants

Outcome #3

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

Number of educational trade articles to increase grower awareness.

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

◉ Change in Knowledge Outcome Measure
◯ Change in Action Outcome Measure
◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	1	8

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
Efforts have been made to increase grower awareness through presentations at grower meetings and publication of trade journal articles.

Results
Presentations/Publications:

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4. Associated Knowledge Areas

- ☐ 133 - Pollution Prevention and Mitigation
- ☑ 211 - Insects, Mites, and Other Arthropods Affecting Plants
- ☐ 212 - Pathogens and Nematodes Affecting Plants
- ☐ 215 - Biological Control of Pests Affecting Plants

Outcome #4

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

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

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

- ◯ Change in Knowledge Outcome Measure
- ◉ Change in Action Outcome Measure
- ◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	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
Root ball drench treatments in combination with ball rotation were again investigated during this reporting period to confirm results from the last reporting period and develop support data for new fire ant and Japanese beetle treatments that are more practical for growers (i.e., fewer total drenches). Tree Ring pre-harvest irrigation treatments were again investigated during this evaluation period, plus 5-gallon buckets were also evaluated for the first time as a possible method to apply pre-harvest insecticides for fire ant and Japanese beetle grub control. Five-gallon buckets are used most frequently by nursery growers to irrigate nursery stock due to a lower cost than Tree Rings. Tractor applied pre-harvest pyrethroid band sprays against fire ants were repeated at a field-grown nursery in combination with mound injection treatments in an effort to eliminate larger, more difficult to control fire ant mounds.

Results
Root ball rotation again improved control of both Japanese beetle and fire ants. Two or four total drenches were effective with rotation for most insecticides evaluated, which is a reduction in total drench number for growers who must currently apply 6 drenches to comply with federal fire ant regulations. Drenches are not approved for treatment of field-grown nursery stock in Japanese beetle regulations, but data from these tests support drench effectiveness with rotation. Root balls in these studies were 30 cm diameter, so larger 60 cm diameter root balls commonly used by the nursery industry need to be evaluated with effective insecticides. Five-gallon bucket treatments were very effective for treating soil, which was subsequently toxic to fire ants in laboratory bioassays. Tree Ring and bucket tests with Japanese beetle have not been completed at this time, but will be evaluated spring 2011. As in the last reporting period, tractor applied pyrethroid bands in combination with injections targeting large-sized mounds were very effective at eliminating fire ants from nursery sites (presently 100% control at 13 weeks after treatment). Evaluations of the tractor-applied pyrethroid/individual mound test are still on-going through spring 2011. All of these tests are indicating promising results for possible new methods to apply fire ant and Japanese beetle treatments.

4. Associated Knowledge Areas

- ☐ 133 - Pollution Prevention and Mitigation
- ☑ 211 - Insects, Mites, and Other Arthropods Affecting Plants
- ☐ 212 - Pathogens and Nematodes Affecting Plants
- ☐ 215 - Biological Control of Pests Affecting Plants

Outcome #5

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

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 Knowledge Outcome Measure
- ○ Change in Action Outcome Measure
- ◉ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

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 three 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

No new insecticides have been submitted for regulatory approval at this time. Tests were performed with two pre-harvest generic imidacloprid-based products (Quali-Pro Imidacloprid 2F and Mallet 2F) and one clothianidin (Arena 50WDG) product. These products were compared against currently approved U.S. Domestic Japanese Beetle Harmonization (DJHP) standards (i.e., Discus and Marathon 60WP).

Results
Test results support the inclusion of Quali-Pro Imidacloprid 2F, Mallet 2F, and Arena 50WDG in the DJHP, based on Japanese beetle grub control efficacy equivalent to approved imidacloprid standards (Discus and Marathon 60WP). It is felt Quali-Pro Imidacloprid and Mallet imidacloprid generics can be added to the DJHP without further testing based on the proven efficacy of imidacloprid. Generic imidacloprid products are lower cost than trade products, reducing grower costs once formerly approved. Clothianidin has provided consistent grub control results three years in a row, including this one, and can now be recommended for addition into the DJHP.

4. Associated Knowledge Areas

- ☐ 133 - Pollution Prevention and Mitigation
- ☑ 211 - Insects, Mites, and Other Arthropods Affecting Plants
- ☐ 212 - Pathogens and Nematodes Affecting Plants
- ☐ 215 - Biological Control of Pests Affecting Plants

Outcome #6

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

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

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

- ◉ Change in Knowledge Outcome Measure
- ◯ Change in Action Outcome Measure
- ◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	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
Confirmation of Hydrangea resistance to powdery mildew. Presentation of information at grower conference.

Results
Research results have been submitted for journal publication. Conference attendees have now increased knowledge of resistant hydrangea cultivars.

4. Associated Knowledge Areas

- ☐ 133 - Pollution Prevention and Mitigation
- ☐ 211 - Insects, Mites, and Other Arthropods Affecting Plants
- ☑ 212 - Pathogens and Nematodes Affecting Plants
- ☐ 215 - Biological Control of Pests Affecting Plants

Outcome #7

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

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

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

- ◉ Change in Knowledge Outcome Measure
- ◯ Change in Action Outcome Measure
- ◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	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
Growers are aware that effective disease management requires early intervention during petal fall when new leaves form.

4. Associated Knowledge Areas

- ☐ 133 - Pollution Prevention and Mitigation
- ☐ 211 - Insects, Mites, and Other Arthropods Affecting Plants
- ☑ 212 - Pathogens and Nematodes Affecting Plants
- ☐ 215 - Biological Control of Pests Affecting Plants

Outcome #8

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

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
- ◯ Change in Action Outcome Measure
- ◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	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
Areas that are at risk for potential disease outbreaks were identified based upon environmental parameters.

Results
Disease severity models were developed based on various environmental parameters and availability of leaves.

4. Associated Knowledge Areas

- ☐ 133 - Pollution Prevention and Mitigation
- ☐ 211 - Insects, Mites, and Other Arthropods Affecting Plants
- ☑ 212 - Pathogens and Nematodes Affecting Plants
- ☐ 215 - Biological Control of Pests Affecting Plants

Outcome #9

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

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

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

◉ Change in Knowledge Outcome Measure
◯ Change in Action Outcome Measure
◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	50	50

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
Resistance to leaf spot diseases were confirmed and cultivars that have moderate disease resistance were identified.

Results
Research results have been communicated to journal for publication. Cultivars resistant to powdery mildew and other foliar diseases were identified; information communicated to producers.

4. Associated Knowledge Areas

- ☐ 133 - Pollution Prevention and Mitigation
- ☐ 211 - Insects, Mites, and Other Arthropods Affecting Plants
- ☑ 212 - Pathogens and Nematodes Affecting Plants

☐ 215 - Biological Control of Pests Affecting Plants

Outcome #10

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

Number of new biopesticde treatments developed

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

◉ Change in Knowledge Outcome Measure
◯ Change in Action Outcome Measure
◯ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	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
All biopesticides tested with container plants during fall 2009 were retested in spring 2010 and trials are underway for fall 2010 and spring 2011. Biopesticides have been tested alone and with low rates of carbaryl (Sevin SL 0.0625 lb AI / 100 gal), bifenthrin (Onyx Pro; 0.0125 lb AI / 100 gal), and trichlorfon (Dylox 420SL; 0.0625 lb AI / 100 gal). In addition, a new biopesticide called Dazitol (capsaicin and related capsaicinoids [0.42%] and allyl isothiocyanate [3.7%])) was tested for the first time in spring 2010 and is being tested now in fall 2010 tests. Armorex (rosemary oil [1%], garlic oil [2%], clove oil [2%], white pepper [0.5%], and sesame oil [84.5%]) and Veggie Pharm (organic coconut oil soap [63.8%], soil oil [19.2%], garlic oil [11%], peppermint oil [0.8%], rosemary oil [0.8%], sodium bicarbonate [2.2%], and potassium chloride [2.2%]) were evaluated for the first time with and without permethrin as trunk sprays against ambrosia beetles.

Results
In spring 2010, all biopesticides provided 100% Japanese beetle grub control when applied to container media in combination with Onyx Pro and Dylox 420SL. The biopesticides Armorex, EcoTrol, and Triact 70 also provided 100% grub control when combined with Sevin SL, but Azatin XL and Cinnacure did not. Dazitol was 100% efficacious against Japanese beetle grubs in containers at rates of 14.2 and 37.9 ml product / gal. Results are not available at this time for fall 2010 or spring 2011 tests. For ambrosia beetles, Armorex, Veggie Pharm, permethrin, and combinations of biopesticides with permethrin provided significantly greater protection of trees from ambrosia beetles than trees that were not protected with the insecticides. Trees were artificially stressed with ethanol injections to induce mass ambrosia beetle attacks, so results indicate potential for biopesticide / insecticide combinations to protect stressed trees from ambrosia beetles.

4. Associated Knowledge Areas

- ☑ 133 - Pollution Prevention and Mitigation
- ☐ 211 - Insects, Mites, and Other Arthropods Affecting Plants
- ☐ 212 - Pathogens and Nematodes Affecting Plants
- ☑ 215 - Biological Control of Pests Affecting Plants

Outcome #11

1. Outcome Measures

☐ Not Reporting on this Outcome Measure

Percent reduction in pesticide movement offsite of research facility

2. Associated Institution Types

☑ 1890 Research

3a. Outcome Type:

- ○ Change in Knowledge Outcome Measure
- ○ Change in Action Outcome Measure
- ◉ Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	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
Multiple commercial biopesticides (Armorex, Azatin XL, Cinnacure, EcoTrol EC, Triact 70) were combined with reduced rates conventional synthetic insecticides (bifenthrin, carbaryl, trichlorfon) and evaluated against third instar Japanese beetle grubs in a container substrate consisting of 80% pine bark 20% peat. Conventional insecticide rates were 18× (bifenthrin) and 128× (carbaryl, trichlorfon) lower than labeled rates.

Results
Neither biopesticides or conventional insecticides have consistently managed Japanese beetle grubs at rates evaluated when tested individually. However, the combination of biopesticides with reduced rates of conventional insecticides provided 100% grub control for most combinations tested. The effectiveness of conventional insecticides at reduced rates when combined with the low residual / environmentally friendly biopesticides, means lower potential for environmental contamination and off-site movement of pesticides.

4. Associated Knowledge Areas

- ☑ 133 - Pollution Prevention and Mitigation
- ☐ 211 - Insects, Mites, and Other Arthropods Affecting Plants
- ☐ 212 - Pathogens and Nematodes Affecting Plants
- ☐ 215 - Biological Control of Pests Affecting Plants

V(H). Planned Program (External Factors)

External factors which affected outcomes

- ☑ Natural Disasters (drought, weather extremes, etc.)
- ☐ Economy
- ☐ Appropriations changes
- ☐ Public Policy changes
- ☑ Government Regulations
- ☐ Competing Public priorities
- ☐ Competing Programmatic Challenges
- ☐ Populations changes (immigration, new cultural groupings, etc.)
- ☐ Other

Brief Explanation

As is the case in much applied agricultural research, weather continues to be a factor that influences the completion of the research. A winter with longer-than-average periods of sub-freezing temperatures reduced fire ant populations significantly. This circumstance made it difficult to find enough experimental units for some of the fire ant research. Populations are expected to rebuild in one to two years.

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

(OPTIONAL SECTION)

1. Evaluation Studies Planned

- ☐ After Only (post program)
- ☐ Retrospective (post program)
- ☑ Before-After (before and after program)
- ☑ During (during program)
- ☐ Time series (multiple points before and after program)
- ☐ Case Study
- ☑ 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.
- ☐ Comparison between locales where the program operates and sites without program intervention
- ☐ Other

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}