V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Agronomic Crop Systems

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	0%	0%	10%	
104	Protect Soil from Harmful Effects of Natural Elements	0%	0%	2%	
111	Conservation and Efficient Use of Water	0%	0%	2%	
112	Watershed Protection and Management	0%	0%	2%	
132	Weather and Climate	0%	0%	1%	
133	Pollution Prevention and Mitigation	0%	0%	1%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%	0%	6%	
202	Plant Genetic Resources	0%	0%	12%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%	0%	8%	
204	Plant Product Quality and Utility (Preharvest)	0%	0%	1%	
205	Plant Management Systems	50%	85%	12%	
206	Basic Plant Biology	0%	0%	2%	
211	Insects, Mites, and Other Arthropods Affecting Plants	5%	0%	16%	
212	Pathogens and Nematodes Affecting Plants	5%	5%	14%	
213	Weeds Affecting Plants	0%	0%	5%	
405	Drainage and Irrigation Systems and Facilities	0%	0%	1%	
511	New and Improved Non-Food Products and Processes	0%	0%	3%	
601	Economics of Agricultural Production and Farm Management	40%	10%	0%	
611	Foreign Policy and Programs	0%	0%	2%	
	Total	100%	100%	100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	13.0	2.0	0.0	0.0
Actual Paid Professional	4.1	2.5	68.2	0.0
Actual Volunteer	5.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
328068	105994	1118049	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1503496	105994	7815373	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
100000	0	4294975	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The Extension portion of this plan includes cotton, irrigation, entomology, plant pathology and row crops management and marketing issues. It is organized via the Innovation-Decision Process (Rogers, 1995). It is important to organize the agronomic crop systems planned program activity in this way because producers of various row crops, in various locations in the state are in different stages of this process for the array of research-based practices. Based on needs assessments conducted by Extension Specialists, the following practices were targeted in 2013: conservation-tillage; planting insect-tolerant crops; planting herbicide-tolerant crops; spaying crops with foliar fungicide to manage disease; using recommended varieties (based on UT field trial results)

Knowledge: Newspaper articles, radio programs, websites and newsletters were used to build awareness of UT Extension resources and practices for more profitable production. Mass media highlighted pests and pesticides in a timely manner.

Persuasion: Farm visits and group meetings were used to teach practices.

Decision: Group meetings and classeswere held in which Extension specialists provided detailed instruction to producers.

Implementation: On-farm demonstrations were conducted, particularly in the 31 West Tennessee counties, to highlight research-based practices. To the extent possible, integrated research and extension was conducted such as result demonstrations and test plots in all 31 West Tennessee counties.

Confirmation: Farm visits and telephone calls were used to assist producers to continue use of the practices, respond to environmental factors, and realize greater profits.

UT AgResearch helps agronomic producers in a variety of areas. Producers of corn, soybeans, wheat, and commercial vegetables are challenged each year with high costs of production, relatively low profit margins, and a host of other issues such as plant diseases, weather, and competition from other

countries in world markets. Because farmers often operate with a relatively low profit margin, economic feasibility as well as efficacy of new genetics or technology for pest and disease control is of paramount importance. Farmers need to be aware of the comparative performance of new technologies in order to make appropriate decisions on pest and disease management. Little information exists about the economics of those technologies and systems under differing production conditions. In addition, the economics of systems vary as the combination of system and production environment change, and as relative prices and costs change.

2. Brief description of the target audience

The primary audience for this program was Tennessee row crop producers, and the secondary audience were the professionals, business owners/cooperatives, and government officials who serve row crop producers.

3. How was eXtension used?

This Agronomic Crop Systems Planned Program was enhanced through the service of three Tennessee Extension personnel and one stakeholder on the "Cotton" CoP and one extension professional and one stakeholder on the "Pesticide Environmental Stewardship" CoP. Tennessee Extension personnel shared implementation strategies, outcome measurement, and evaluation protocols with their CoP colleagues.

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	25830	331344	1773	0

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

Patent Applications Submitted

Year:	2013
Actual:	9

Patents listed
1. Seed treatment supplement, foliar spray, or in-furrow granule for control of seedling diseases of agronomic crops (Canaday)
2. Soak Chamber and System to Measure the Seed Density Hydration Profile of Seeds (Harte, Mannam, Worley, Wilkerson, Smith)
3. Novel herbicide resistance gene (Chen, Zhao, Armel)
4. Utilization of Caffeine and Related Xanthine Alkaloids for the Control of Nematodes (Chen, Hewezi)
5. A method for the production of turfgrass sod using a soil--less biodegradable root zone medium (Sorochan, Thoms)
6. Synthetic TAL effectors for targeted gene activation in plants. (Stewart, Liu, Chestnut)
7. ABC transporter ATABCG16 inreases plant tolerance to abscisic acid and assists in basal resistance against Pseudomonas syringae (Stewart, Peng, Traw, Ji)
8. Genes to increase growth in corn and other monocots (Stewart, Mann, Poovaiah)
9. Expression profiles of CAB1-2-P and PSBR-P in transgenic rice plants (Stewart, Peng, Ye)

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	15	74	89

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of exhibits displayed to promote awareness and participation in this planned program. Not reporting on this Output for this Annual Report

Output #2

Output Measure

- Number of research-based publications distributed as part of this program.

Year	Actual
2013	3986

Output #3

Output Measure

- Research projects to develop irrigation recommendations for cotton and soybeans (Verbree)

Year	Actual
2013	2

Output #4

Output Measure

- Meta-analysis of Mycorrhizal Impact on Stomatal Conductance (Auge)

Year	Actual
2013	1

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Row Crops Production: Number of participants who implemented one or more management practices based on data provided by UT (e.g., conservation tillage, plant population, growth retardants, IPM strategies, disease and weed control).
2	Row Crops Production: Number of producers, farm workers and other ag professionals who received pesticide certification, recertification and pesticide safety training.
3	Row Crops Production: Number of participants who improved their income by following the recommended best management practices for crop production, including plant pest management.
4	Adoption and Abandonment of Precision Farming (Roberts)
5	Automatic Section Control for Planters (Buschermohle)
6	Combatting Pigweed in Cotton and Soybeans (Steckel)
7	Fight Fungal Pathogens of Snap Bean and Soybean (Canaday)
8	Enhance bioactive food components (Kopsell, Armel, Sams, Deyton)
9	Genetically improve soybean yields (Pantalone)
10	Identify a Potentially Serious Corn Pathogen (Bernard)
11	Microbial Community Structure With No-till
12	Appropriate use of Unmanned Aircraft Systems (Freeland)
13	Determining adherence to USGA putting greens standards (Freeland)
14	Develop new cereal varieties (West)
15	Increase soybean yield by double-cropping canola (West)
16	Address Genetic Resistance to Bt Toxins (Jurat-Fuentes)
17	Investigate insect resistance to biopesticides (Jurat-Fuentes)

18	Publicize Kudzu Management (Rhodes)
19	Reduce Phosphorous Pollution, Improve Animal Nutrition (Pantalone)
20	Identify Microbial Community Structure With No-till (Tyler)
21	Attack the Soybean cyst Nematode (Hewezi)

Outcome #1

1. Outcome Measures

Row Crops Production: Number of participants who implemented one or more management practices based on data provided by UT (e.g., conservation tillage, plant population, growth retardants, IPM strategies, disease and weed control).

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	1531

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

Outcome #2

1. Outcome Measures

Row Crops Production: Number of producers, farm workers and other ag professionals who received pesticide certification, recertification and pesticide safety training.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	667

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Commercial and private applicators, structural pest control operators, farmers, landscapers and others need training in pesticide safety to ensure Federal and state regulations are followed for public safety.

What has been done
Online materials were developed to provide individuals information concerning the PSEP program as well as current pest related issues. Pesticide Safety and Education Training sessions were taught at 17 separate meetings.

Results
Well-educated pesticide applicators are better equipped to control pest problems safer and more effectively. Pesticide safety education helps reduce the incidence of pesticide misuse, spills and undesirable damage to non-target organisms.
?587 commercial applicators were trained in various pesticide categories.
?80 private applicators received initial certification via online training.

4. Associated Knowledge Areas

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

Outcome #3

1. Outcome Measures

Row Crops Production: Number of participants who improved their income by following the recommended best management practices for crop production, including plant pest management.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	1531

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
601	Economics of Agricultural Production and Farm Management

Outcome #4

1. Outcome Measures

Adoption and Abandonment of Precision Farming (Roberts)

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Precision farming (PF) provides information about the spatial variability within a farm field and can improve the efficiency of inputs through variable-rate applications.

What has been done
Identifying the factors that influence farmers perceptions of PF as a means to improve the efficiency of nitrogen (N), phosphorus (P) and potassium (K) fertilizer applications can be useful in targeting specific groups of farmers for PF adoption to increase fertilizer efficiency and reduce N, P and K losses to the environment. We used data from a survey of cotton farmers in the southern United States to identify these factors.

Results
Results suggest that yield monitoring, precision soil sampling, and on-the-go sensing increased farmers' perception of PF in improving fertilizer efficiency. Farmers who rented a larger portion of the land they farmed thought PF improved the efficiency of N, P and K applications, possibly because they knew less about the spatial variability of rented fields than owned fields before adopting PF, providing more room for improvement in efficiency.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
104	Protect Soil from Harmful Effects of Natural Elements
205	Plant Management Systems
601	Economics of Agricultural Production and Farm Management

Outcome #5

1. Outcome Measures

Automatic Section Control for Planters (Buschermohle)

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
A common problem in planting operations is overlapped planted area due to encroachment in point and end rows, during headland turns, and when avoiding obstacles within a field boundary. Swath overlap from input application operations such as planting is determined by factors such as field shape, field obstructions, field size, implement width, direction of the field work tracks, and equipment operator accuracy. Seed expenses in agricultural production have risen 95% in the last decade and continue to rise, due mainly to producers planting relatively more expensive genetically-modified seeds. Thus, farmers are looking for technologies that reduce seed costs and enhance productivity.

What has been done
Automatic Section Control (ASC) for planters is a technology that can reduce or eliminate double-planting and therefore, reduce seed costs and improve yields. This analysis used planter overlap data from 52 farm fields in Tennessee to evaluate net returns to Automatic Section Control (ASC) for planters by reducing seed costs and increasing revenue. Potential savings from adopting ASC system for planters were evaluated using this information.

Results
Tennessee row crop producers lowered chemical costs and potential losses to the environment by an average of 7% by reducing off-target application errors on 629280 acres with the adoption of automatic section control technology on their sprayers. According to a survey of cotton producers in 2013, approximately 34% of cotton producers in Tennessee have been adopted Automatic Section Control for planters on approximately 82,400 acres. It is estimated that adoption of ASC for planters on these numbers of acres represents a $870,000 on total savings for these farmers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
104	Protect Soil from Harmful Effects of Natural Elements
205	Plant Management Systems
601	Economics of Agricultural Production and Farm Management

Outcome #6

1. Outcome Measures

Combatting Pigweed in Cotton and Soybeans (Steckel)

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
We have identified glyphosate-resistant Palmer amaranth in 10 counties. Most of these cases are spots of GR Palmer ranging from the size of a car to several acres to in a few cases the whole field.

What has been done
We have been able to see a high level of grower and consultant adoption of our research findings. In a survey of cotton growers and consultants, 60% of the growers and 100% of the consultants made changes in their weed control programs based on information from UT research.

Results
They estimated the value per acre of these changes at $40 per acre on the 590,000 acres of cotton for a total of $23.6 million impact. At a middle TN grain conference, 96% of the respondents indicated they made changes in their weed control programs based on this research and resulting recommendations.

4. Associated Knowledge Areas

KA Code	Knowledge Area
104	Protect Soil from Harmful Effects of Natural Elements
205	Plant Management Systems
213	Weeds Affecting Plants
601	Economics of Agricultural Production and Farm Management

Outcome #7

1. Outcome Measures

Fight Fungal Pathogens of Snap Bean and Soybean (Canaday)

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In terms of acreage, snap bean is the leading vegetable crop in Tennessee; and seedling diseases are the principal reason for yield reduction and loss of grower profits. Soybean is one of the leading agronomic crops in Tennessee. The Production Committee of the United Soybean Board (USB) has recognized the impact of soybean seedling diseases on both soybean yield and quality. Surveys conducted by the USB have indicated that seedling diseases had the greatest impact on soybean yield of all disease pests other than soybean cyst nematode.

What has been done
The soilborne fungal pathogens attacking the seedlings of both crops are the same. The field and laboratory experiments conducted at the WTREC in 2013 sought to improve the control of this seedling disease complex.

Results
While the soybean field experiments failed to identify a method to reduce soybean seedling diseases, the snap bean experiments identified an experimental seed treatment supplement that reduced the incidence of snap bean seedling diseases by over 30% and increased snap bean yield by over 60%. A provisional patent application was submitted for this seed treatment supplement.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
212	Pathogens and Nematodes Affecting Plants
601	Economics of Agricultural Production and Farm Management

Outcome #8

1. Outcome Measures

Enhance bioactive food components (Kopsell, Armel, Sams, Deyton)

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Increasing concentrations of nutritionally important bioactive food components in specialty crops.

What has been done
Identified the influence of genotype on concentrations of nutritionally important bioactive food components in specialty crops.

Results
Demonstrated the ability to successfully select cultivars with higher propensity for accumulating greater concentrations of nutritionally important food components.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)

Outcome #9

1. Outcome Measures

Genetically improve soybean yields (Pantalone)

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
More than half of all gains in USA agricultural production have been through genetic improvement. Genetic improvement of soybeans is vital to sustaining the economic livelihood of farmers in Tennessee and the Mid-South region.

What has been done
Soybean varieties developed by our program and released by UT AgResearch were produced over an estimated 28,000 acres during the past three years (2011-2013).

Results
During this three-year time period, Tennessee state soybean production averaged an outstanding 39.3 Bu/A coupled with an excellent $13.25 soybean commodity price average. Thus 28,000 acres x 39.3 Bu/A x $13.25/Bu provided more than $14.5 million impact in direct revenue to the farmers who grew our new UT AgResearch varieties. The exceptional yield of the new Ellis soybean that we released this year will provide further increases in revenue to Tennessee soybean producers. (Pantalone)

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
601	Economics of Agricultural Production and Farm Management

Outcome #10

1. Outcome Measures

Identify a Potentially Serious Corn Pathogen (Bernard)

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done
Recognition and publication of the description of a new genus and species of cyst nematode, Vittatidera zeaphila, makes it possible for growers, extension agents, and ag scientists to identify this potentially serious pathogen of corn in the mid-South.

Results
Scientists are already testing available corn lines for sources of resistance. (Bernard)

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
212	Pathogens and Nematodes Affecting Plants
601	Economics of Agricultural Production and Farm Management

Outcome #11

1. Outcome Measures

Microbial Community Structure With No-till

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
It has generally been thought that no-till systems result in higher fungal populations compared to tilled systems.

What has been done
We evaluated populations on a long-term cotton experiment with tillage and legume and grass cover crop combinations.

Results
On the silt loam soil studied, the bacterial populations in all treatments were not dominated by fungi but by bacteria indicating a better microbial community structure as a result of no-tillage. (Tyler)

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
206	Basic Plant Biology
212	Pathogens and Nematodes Affecting Plants
601	Economics of Agricultural Production and Farm Management

Outcome #12

1. Outcome Measures

Appropriate use of Unmanned Aircraft Systems (Freeland)

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Spurred by the FAA?s congressional mandate to fully integrate Unmanned Aircraft Systems (UASs) into the nation's airspace, a significant number of bills, particularly in state legislatures, have been introduced in an attempt to regulate UAS use. Although geared toward privacy protection and law enforcement, some laws may adversely affect agriculture because they create legal uncertainty and/or they sweepingly ban or highly curtail local UAS operations.

What has been done
Our project examined the nature of the current debate surrounding the UAS within the U.S., analyzes the impact on agriculture from the legislation considered, discusses policy options to ameliorate the controversy, and describes the factors that will likely determine UAS operations within the U.S. The information was obtained from government documents, academic research, industry studies, nonprofit organizations, and media reports. An analysis was done using these data on how UAS legislation may affect precision agriculture.

Results
Possible solutions have been proposed: 1) Reducing the legal uncertainty regarding UASs, 2) Adopting an industry Code of Conduct and Safe Practices, and 3) Producing a consensus on UAS regulations among diverse groups through an open discussion of how to balance UAS operations with safeguards on privacy and property rights. The economic potential of the UAS, particularly in agriculture, combined with the lobbying power of the UAS industry, strongly suggest that policy will eventually be developed that will allow the use of this technology for precision agriculture in U.S. airspace.

4. Associated Knowledge Areas

KA Code	Knowledge Area

204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
601	Economics of Agricultural Production and Farm Management

Outcome #13

1. Outcome Measures

Determining adherence to USGA putting greens standards (Freeland)

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
We need to discover conformity (or lack thereof) to the design specifications of putting greens.

What has been done
A study with Ohio State introduced a nonintrusive survey protocol that combines ground?-penetrating radar (GPR) and real-time kinematic (RTK) positioning. A case study was used to examine a putting green designed using the USGA specifications. The protocol created ?as-built? subsurface maps.

Results
The protocol non-intrusively identified the tile slope and spacing. It also determined the depth and thickness of the root-zone mixture and gravel. The green adhered to the tile spacing specification, but failed to meet specifications as to tile slope and root-zone mixture depth. These findings suggest that this protocol supplies a relatively inexpensive method to determined adherence to USGA greens standards. Generated maps highlighted conformity (or lack thereof) to the design specifications.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
405	Drainage and Irrigation Systems and Facilities

511	New and Improved Non-Food Products and Processes
601	Economics of Agricultural Production and Farm Management

Outcome #14

1. Outcome Measures

Develop new cereal varieties (West)

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done
We are developing new cereal varieites that increase grain yield.

Results
New wheat variety Charlie produced 6 bushels/acre more than the average of 44 varieties in the Tennessee State Wheat Variety trial in 2012 and 2013. If this variety replaced an average variety on one-fourth of the wheat acres in Tennessee it would add 800,000 bushels of production and 4.8 million dollars of income for Tennessee's farmers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
601	Economics of Agricultural Production and Farm Management

Outcome #15

1. Outcome Measures

Increase soybean yield by double-cropping canola (West)

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Need for higher yields of soybeans.

What has been done
Double-cropping canola followed by soybean could increase soybean yields 3 bushels/acre compared to the traditional wheat-soybean double crop sequence.

Results
This would add approximately $36/acre in income for Tennessee?s soybean producers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems
601	Economics of Agricultural Production and Farm Management

Outcome #16

1. Outcome Measures

Address Genetic Resistance to Bt Toxins (Jurat-Fuentes)

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Transgenic Bt corn represents >70% of the corn grown in the US, yet resistance has been reported for populations of armyworms in Puerto Rico. This is the first reported case of resistance resulting in field crop failures and withdrawal of the Bt crop. The resistance mechanism involved, its potential spread to mainland US, and the potential for cross-resistance in these armyworms are critical issues.

What has been done
We generated a population of armyworms that we keep under constant selection with transgenic corn.

Results
Using this population we identified a gene that is down-regulated in resistant armyworms, and this down-regulation is linked to resistance to Bt corn, which should allow us to develop efficient monitoring tools. Using these insects we also determined that there is cross-resistance to alternative Bt corn varieties but not to currently available Bt biopesticides, alleviating one of the main concerns for organic growers. In addition, the tools developed with this population of insects are allowing us to compare populations from diverse geographies to determine spread of resistance allele among armyworm populations.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
205	Plant Management Systems

211	Insects, Mites, and Other Arthropods Affecting Plants

Outcome #17

1. Outcome Measures

Investigate insect resistance to biopesticides (Jurat-Fuentes)

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Some insects can develop resistance against Bt biopesticides, which contain many different insecticidal proteins. The mechanism allowing for this broad resistance is not known. Insects can develop resistance to biopesticides and entomopathogens by improving their gut regenerative response.

What has been done
We have performed genomic and proteomic analyses to identify genes that have altered expression in resistant insects to elucidate physiological changes that correspond with resistance. We have identified one of the proteins that seems responsible for the activation of the gut regenerative response by activation of stem cells.

Results
This allows directed action against expression of this gene to limit the gut healing process and render insects highly susceptible to diverse insecticidal technologies.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
211	Insects, Mites, and Other Arthropods Affecting Plants

Outcome #18

1. Outcome Measures

Publicize Kudzu Management (Rhodes)

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Kudzu, a non-native, invasive weed is very problematic in Tennessee and the rest of the southeastern United States.

What has been done
A video covering the biology and management of this weed was produced.

Results
This continues to be the number one UTIA video on YouTube. Since its introduction, it has been viewed 80,747 times (up from 63,913 through 2011), and 41 percent of the viewings were on mobile devices. It has wide national and international viewership, and it has been used as a part of the academic instruction program of the United Kingdom's Open University. Top viewing locations include the U.S., Canada, the United Kingdom, Germany and France.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
213	Weeds Affecting Plants
511	New and Improved Non-Food Products and Processes
601	Economics of Agricultural Production and Farm Management

Outcome #19

1. Outcome Measures

Reduce Phosphorous Pollution, Improve Animal Nutrition (Pantalone)

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Corn and soybean naturally contain a phosphorous compound known as phytate which is not digestible by poultry or swine. The phytate molecule also binds positively charged minerals such as calcium, iron, and zinc in the feed meal, reducing their nutritional availability to livestock.

What has been done
Soybean researchers in southern states have for several years been attempting to break a genetic linkage between one of the two soybean phytate genes and a soybean growth habit gene.

Results
Our laboratory was the first to accomplish this, and we now have new low phytate soybean lines that are well adapted to production in the southern U.S.

4. Associated Knowledge Areas

KA Code	Knowledge Area
104	Protect Soil from Harmful Effects of Natural Elements
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources

Outcome #20

1. Outcome Measures

Identify Microbial Community Structure With No-till (Tyler)

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
It has generally been thought that no-till systems result in higher fungal populations compared to tilled systems.

What has been done
We evaluated populations on a long-term cotton experiment with tillage and legume and grass cover crop combinations.

Results
On the silt loam soil studied, the bacterial populations in all treatments were not dominated by fungi but by bacteria indicating a better microbial community structure as a result of no-tillage.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
206	Basic Plant Biology

Outcome #21

1. Outcome Measures

Attack the Soybean cyst Nematode (Hewezi)

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done
The functional roles of the phytohormone auxin in the initiation and formation of nematode feeding sites were described. These findings represent fundamental breakthroughs not only for our understanding of the establishment of nematode feeding site but also for the function of the phytohormone auxin as a morphogenetic trigger of organogenesis.

Results
A novel mechanism of cyst nematode parasitism of host plant has been discovered. New miRNA genes have been identified that are involved in biotic stress responses. A rapid and effective method to quantify soybean resistance to nematode infection was disclosed.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
205	Plant Management Systems
212	Pathogens and Nematodes Affecting Plants

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Cotton was planted and harvested on over 250,000 acres in Tennessee in 2013. The 2013 growing season was characterized by late planting, and cool and relatively wet conditions persisted though the season. The statewide average yield was approximately 850 pounds of lint per acre, and was limited by insufficient heat units to mature late planted cotton fields. Increasing production costs and relatively flat commodity prices are the greatest challenges facing Tennessee cotton producers.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Evaluation of UT Extension's cotton production program included on-farm interviews and surveys with producers. Results demonstrated:

- Producers increased yield by 602 pounds by selecting top yielding varieties on 209,475 acres of cotton.
- 212,551 acres of cotton scouted by a producer or independent crop consultant to help make crop management decisions, and 53,652 acres of cotton scouted by a UT-trained scout to help make crop management decisions.
- 530 cotton producers adopted UT recommended resistance management strategies to control pests (weeds, insects and diseases).
- 497 cotton producers increased their knowledge of recommended agronomic practices and understanding of their benefits and use.
- 154 cotton producers report an $85,294 reduction in pest control costs by following recommended control strategies for insects, weeds or plant diseases.
- 508 cotton producers used data provided by UT publications or UT Internet resources and made changes in their production practices.

Key Items of Evaluation

- 154 cotton producers report an $85,294 reduction in pest control costs by following recommended control strategies for insects, weeds or plant diseases.
- 508 cotton producers used data provided by UT publications or UT Internet resources and made changes in their production practices.