

V(A). Planned Program (Summary)

Program # 12

1. Name of the Planned Program

Horticultural 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%	9%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%	0%	6%	
202	Plant Genetic Resources	0%	0%	4%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%	0%	2%	
204	Plant Product Quality and Utility (Preharvest)	0%	20%	0%	
205	Plant Management Systems	60%	70%	12%	
211	Insects, Mites, and Other Arthropods Affecting Plants	10%	0%	6%	
212	Pathogens and Nematodes Affecting Plants	0%	5%	43%	
213	Weeds Affecting Plants	10%	0%	6%	
215	Biological Control of Pests Affecting Plants	0%	0%	2%	
216	Integrated Pest Management Systems	10%	5%	6%	
312	External Parasites and Pests of Animals	10%	0%	0%	
607	Consumer Economics	0%	0%	4%	
	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	36.0	4.5	26.0	0.0
Actual Paid Professional	36.0	5.0	24.3	0.0
Actual Volunteer	10.0	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
640134	206818	751351	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
2933650	206818	1918927	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	1159168	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Variety evaluation of several different vegetable crops will be conducted to determine suitability to climate, soils and cultural practices for state producers. Yields, quality and market potential will be evaluated to assess potential production by growers seeking additional crops or alternative crops. Crops suitable for greenhouse production in farmers tobacco transplant greenhouses will be evaluated for profitability and product quality with respect to local and state markets.

UT AgResearch efforts determine the effectiveness of various control technologies, develop new genetic cultivars of plants from in-house breeding programs or, in some cases, find naturally resistant populations of plants by searching the southeast U.S. (i.e. for anthracnose resistant dogwoods).

Research is conducted at selected Research and Education Centers across Tennessee, and at several farmer-cooperator locations in key areas of horticultural production in Tennessee. Substantial investments have just been made in construction and renovation of greenhouse facilities on campus and at certain Research and Education Centers. These will be utilized extensively in the conduct of our research.

TSU Extension works with the community and schools to develop community gardens for the purpose of improving food security and promoting community resource development. It evaluates the suitability, marketability and profitability of alternative and niche crops for small and limited resource producers. It has created its own community garden at the TSU Agricultural Research and Education Center to enhance food security, outreach and education for residents living in a portion of Nashville known to be a food desert.

2. Brief description of the target audience

- Farmers/producers who had traditional livestock and tobacco operations, but were looking to improve income through the Green Industry.
- Master Gardeners who volunteered to provide community service through horticulture.
- Business owners who needed research-based information to start, maintain or expand their greenhouse, landscaping, or nursery business.

- Urban and rural limited resource and under-served youth and adults

3. How was eXtension used?

This Horticultural Systems planned program was enhanced through the service of 14 Tennessee Extension personnel on the "Consumer Horticulture" 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	284492	2090083	112940	0

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

Patent Applications Submitted

Year: 2013

Actual: 3

Patents listed

1. Empire Dogwood (Evans, Trigiano, Wadl, Windham)
2. Red Steeple Dogwood (Evans, Trigiano, Wadl, Windham)
3. Pam's Mountain Bouquet Dogwood (Evans, Trigiano, Wadl, Windham)

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	1	45	48

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Horticultural workshops and conferences.

Year	Actual
2013	12

Output #2

Output Measure

- Number of exhibits displayed to teach best practices in horticultural systems.

Year	Actual
2013	295

Output #3

Output Measure

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

Year	Actual
2013	28293

Output #4

Output Measure

- Continue to investigate resistant mechanisms (traits) for dogwood anthracnose in flowering dogwood. (M. Windham)

Year	Actual
2013	0

Output #5

Output Measure

- Understand the secondary effects of chemical applications that will allow turfgrass managers to better use these products, to save money and reduce overall inputs to the environment. (Brosnan, Horvath)
Not reporting on this Output for this Annual Report

Output #6

Output Measure

- Demonstrated use of rootstocks to increase field-grown tomato yield (Deyton)

Year	Actual
2013	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Consumer Horticulture: Number of consumers who applied fewer fertilizers and pesticides due to a better understanding of landscape best management practices.
2	Consumer Horticulture: Number of consumers who learned about plant selection and proper planting to save money and time in the landscape.
3	Extension Responds to the Needs of Tennessee's Ornamental Horticulture Industry
4	Turfgrass Weed Management Strategies
5	Assessing and reintroducing <i>Pityopsis ruthii</i> (Trigiano, Wadl)
6	Brassica and Se effects on nutrition and cancer (Sams)
7	Gentic diversity in dogwood cultivars (Windham, Windham, Trigiano, Wadl)
8	Downy mildew control (Lamour, Trigiano)
9	Fungal resistance in tomato (Bost)
10	Greenhouse production (Deyton, Sams)
11	Late blight in tomato (Bost)
12	Molecular Markers for Horticultural Traits (Trigiano, Ownley, Wadl)
13	Mustard seed meal biofumigation of strawberries (Deyton, Sams)
14	Nursery participation in Ag Enhancement Program funding (Fulcher)
15	Off-target damage from pasture herbicides (Rhodes)
16	Olive production in Tennessee? (Ownley)
17	Organic initiative (Wszelaki)

18	Rose rosette virus (Windham)
19	Taro Leaf Blight pathogen (Lamour)
20	Better timing of pesticide applications (Klingeman)
21	Using genetics against Phytophthora blight (Lamour)

Outcome #1

1. Outcome Measures

Consumer Horticulture: Number of consumers who applied fewer fertilizers and pesticides due to a better understanding of landscape best management practices.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	1552

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
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants

216 Integrated Pest Management Systems

Outcome #2

1. Outcome Measures

Consumer Horticulture: Number of consumers who learned about plant selection and proper planting to save money and time in the landscape.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	3831

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
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems

Outcome #3

1. Outcome Measures

Extension Responds to the Needs of Tennessee's Ornamental Horticulture Industry

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

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)

Challenges facing the commercial horticulture industry include marketing, sustainable cultural practices, environmental and human health risks, invasive species, regulations, and profitability.

What has been done

Extension personnel conducted commercial nursery and landscape educational programs reaching over 22,817 direct contacts during 2013. More than 11,600 direct mail and telephone calls were made to assist the commercial ornamental horticulture industry. Best production and landscape management practices were taught at 684 group meetings and over 300 on-site visits.

Results

The total economic impact of Extension's commercial ornamental and landscape horticulture programming was estimated at \$474,150 in increased savings, increased income, and one-time capital purchases. Additional impacts included:

- ?370 professionals added additional services and/or marketing practices.
- ?218 professionals developed or made adjustment to their business plans.
- ?1150 professionals implemented recommended cultural practices: fertilization, soil sampling, propagation, irrigation, etc.
- ?788 professionals implemented recommended management practices for pest control.
- ?1140 professionals increased their knowledge of plant culture (e.g. fertilization, soil mixing and/or sampling, propagation, irrigation, transplanting and installation).
- ?1361 professionals increased their knowledge of plant pests and integrated pest management.
- ?1556 professionals increased their knowledge of proper plant selection.
- ?837 professionals practiced proper plant selection and installation practices.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
216	Integrated Pest Management Systems

Outcome #4

1. Outcome Measures

Turfgrass Weed Management Strategies

2. Associated Institution Types

- 1862 Extension

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)

Turfgrass professionals and homeowners need effective and economical methods for controlling turfgrass weeds. The cost of controlling weeds in highly maintained turf was reported to be \$200 million in 1994, and increases at a rate of 2-5% annually.

What has been done

In 2013, UT Extension launched a mobile website to assist practitioners in selecting herbicides for use in turfgrass and ornamental areas, <http://mobileweedmanual.com>. The site was optimized for use on mobile devices such as smartphones and iPads. This site was reviewed by colleagues at peer-institutions, and it was used by over 12,000 individuals in 100 different countries, all 50 U.S. states, and 166 municipalities in Tennessee.

Results

UT Extension focused on effective, economical strategies for controlling weeds in various turfgrass areas. Our results indicated that proper turfgrass management practices translate to fewer applications of herbicides, which consequently produced substantial savings for turfgrass managers. We estimated that in 2013, \$10 million was saved from adoption of Extension turfgrass recommendations.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
213	Weeds Affecting Plants

Outcome #5

1. Outcome Measures

Assessing and reintroducing *Pityopsis ruthii* (Trigiano, Wadl)

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)

Pityopsis ruthii (Ruth's golden aster) has a high potential to yield previously unknown genes or gene pathways and physiological changes associated with drought and flood tolerance because it has evolved tolerance to extreme environments, seemingly without significant modification of plant architecture, anatomy, or development. Plant breeders, geneticists, and researchers developing models for drought tolerance in agronomic crops will benefit from an additional robust genetic model for environmental tolerance in a small, flowering dicot.

What has been done

We now have the tools to assess genetic diversity of the endangered species, *Pityopsis ruthii*. Our clonal tissue culture production system may allow us to reintroduce the plant into native habitats and aid in the total recovery program for this species.

Results

We have identified several diseases found on *P. ruthii* that may impact the production of this plant as an ornamental. Also, we have identified several insects pest that occur on the plant. Both insect and diseases may impact *P. ruthii* as an ornamental plant and delay the formation of a new company designed to propagate and introduce new plants into the ornamental industry.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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- 201 Plant Genome, Genetics, and Genetic Mechanisms
- 202 Plant Genetic Resources
- 204 Plant Product Quality and Utility (Preharvest)
- 211 Insects, Mites, and Other Arthropods Affecting Plants
- 212 Pathogens and Nematodes Affecting Plants

Outcome #6

1. Outcome Measures

Brassica and Se effects on nutrition and cancer (Sams)

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)

Nutrition plays a role in cancer growth.

What has been done

We demonstrated that foliar applications of Se can increase Se content in Brassica vegetables while still maintaining high levels of glucosinolates. We demonstrated that ITCs from Brassica decreased the growth of Human Colon Cancer cells in vitro and that Se also decreased the cancer cell growth.

Results

Brassica vegetables high in both Se and Glucosinolates will provide improved human nutrition benefits. We continue to investigate the potential synergistic impact of the two metabolites on cancer growth.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)

Outcome #7

1. Outcome Measures

Genetic diversity in dogwood cultivars (Windham, Windham, Trigiano, Wadl)

2. Associated Institution Types

- 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)

Demonstration of non-significant loss of genetic diversity of flowering dogwood in the eastern United States is important to selection/breeding of new dogwood cultivars for Tennessee nursery industry.

What has been done

The genetic diversity of flowering dogwood in the GSMNP is intact despite massive dieoffs due to dogwood anthracnose. Dogwoods in the park will not disappear as once thought. Accelerated breeding of flowering dogwood cultivars with improved disease resistance, heat or drought tolerance, and other aesthetically appealing ornamental traits can now be enhanced with EST-SSRs via transcriptomics.

Results

The new cultivars, especially 'Mountain Bouquet' represent something entirely new in *C. kousa* cultivars. The fused bracts of 'Mountain Bouquet' should make this tree an excellent seller in Japan and the upright forms of 'Empire' and 'Red Steeple' make them ideal for avenue plantings in Japan. We believe that these trees will be excellent products for TN grower and improve the nursery's financial position through greater sales.

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)
205	Plant Management Systems

212 Pathogens and Nematodes Affecting Plants
607 Consumer Economics

Outcome #8

1. Outcome Measures

Downy mildew control (Lamour, Trigiano)

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)

Downy mildew epidemics damage spinach.

What has been done

Population structure of two important downy mildew species can now be studied using Site-Specific Recombinase (SSR) technology. Information on the genetic structure of these populations is important for understanding the life history of the pathogens and developing control and management strategies for the diseases. For our downy mildew of spinach project our goal was development of novel molecular markers useful to track epidemics in space and time.

Results

We've identified thousands of new markers and are currently applying them to populations in Arizona where disease pressure is heavy.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
204	Plant Product Quality and Utility (Preharvest)

205	Plant Management Systems
212	Pathogens and Nematodes Affecting Plants

Outcome #9

1. Outcome Measures

Fungal resistance in tomato (Bost)

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)

Tomato crops are sprayed routinely to minimize damage from diseases, primarily early blight. The spray products used to control early blight had become ineffective, due to the development of resistance in the causal fungus.

What has been done

Research was conducted to identify effective alternative control products, and to design spray programs that accommodated these products.

Results

Those spray programs were then verified in a full-season field trial. Within a year of the recognition of the resistance problem, growers were notified of the new spray programs and the need to use them, beginning with the Fall 2013 crop.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
212	Pathogens and Nematodes Affecting Plants
607	Consumer Economics

Outcome #10

1. Outcome Measures

Greenhouse production (Deyton, Sams)

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)

Growers face both new and chronic pest and disease obstacles to production.

What has been done

We developed and refined Greenhouse production practices for several crops including strawberry, tomato, pepper, galea melon, and cucumber.

Results

We identified promising strawberry cultivars for fall and winter greenhouse production. We continued to demonstrate that Biologicals controls can be used to control mite, thrip, aphid and white fly populations. Greenhouse tomato yields have been increased to over 24 pounds per plant on a short harvest spring crop. This yield should prove to be commercially successful for growers interested in greenhouse vegetable production. We evaluated cultivars for quality and yield as a spring and fall crop. We assisted numerous growers with setting up greenhouse production systems based on our research results.

4. Associated Knowledge Areas

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

205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems
607	Consumer Economics

Outcome #11

1. Outcome Measures

Late blight in tomato (Bost)

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)

Late blight is a disease of tomato that seldom occurs but can inflict ruin on a tomato crop.

What has been done

The sudden appearance of this disease in 2013 was met with an educational program of newsletter and newspaper articles. Gardeners and commercial growers were alerted to the presence of the disease and the threat it posed.

Results

Remedial treatments contributed to saving much of the \$50 million commercial crop and home garden tomatoes.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

212 Pathogens and Nematodes Affecting Plants
607 Consumer Economics

Outcome #12

1. Outcome Measures

Molecular Markers for Horticultural Traits (Trigiano, Ownley, Wadl)

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)

Development of genetic linkage maps for dogwood and redbud will lay a foundation for marker assisted selection for desirable traits.

What has been done

Clarification of the phylogenetic relationships and development of marker systems for the aforementioned ornamentals will aid in breeding inter- and intra-specific hybrids. Additionally, proprietary materials may be identified and legally protected if necessary using unique DNA markers developed in our laboratory.

Results

Results of the redbud study support previously reported phylogenetic relationships of the North American and western Eurasian species and indicate suitability of these markers for mapping studies involving *C. canadensis* and *C. chinensis*. Results also support pedigrees from ornamental tree breeding programs for the widely cultivated *C. canadensis* and *C. chinensis* species, which are important ornamentals in the US and comprised the majority of the samples analyzed. We have been contacted by a number of large producers of redbud seeking information on the genetics of their redbuds and how to protect and enforce their plant patents.

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)
205	Plant Management Systems
212	Pathogens and Nematodes Affecting Plants

Outcome #13

1. Outcome Measures

Mustard seed meal biofumigation of strawberries (Deyton, Sams)

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 to increase yields of strawberries.

What has been done

Two research trials demonstrated that biofumigation with mustard meal in late summer before autumn planting of plasticulture strawberries can increase spring-time yields compared to untreated plots.

Results

The mustard meal treatment did not control weeds but apparently modified soilborne micro-organism populations. In a commercial planting, yields from mustard meal treated plots were the same as yields from conventionally fumigated (PicChlor60) plots. The mustard meal treatment may be especially beneficial for organic growers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

- 211 Insects, Mites, and Other Arthropods Affecting Plants
- 212 Pathogens and Nematodes Affecting Plants
- 213 Weeds Affecting Plants
- 215 Biological Control of Pests Affecting Plants
- 216 Integrated Pest Management Systems

Outcome #14

1. Outcome Measures

Nursery participation in Ag Enhancement Program funding (Fulcher)

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)

Tennessee nursery producers were not offered the same opportunity that producers of other agricultural products were to compete for Tennessee Ag Enhancement Program (TAEP) funding.

What has been done

I formed a committee that a) proposed to develop the Tennessee Master Nursery Producer program to the Tennessee Department of Agriculture as a qualifier for this funding, b) prepared a proposal for a Specialty Crops Block grant to fund the program, and c) used the grant funding to develop the course.

Results

In 2012, 45 people participated in this course. Graduates estimated saving an average of \$4,272 per grower for a total of \$192,240. In addition, course graduates enrolled in the TAEP qualified for 50% rather than 35% in cost share on their TAEP grant, saving an additional \$27,523.

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
607	Consumer Economics

Outcome #15

1. Outcome Measures

Off-target damage from pasture herbicides (Rhodes)

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)

Most high-value crops in Tennessee, such as tobacco (\$3,500/A) and tomato (\$11,470/A) are very sensitive to most pasture herbicides, and off-target problems with these herbicides have been numerous over the past 40-plus years.

What has been done

The recent development of highly active, persistent pasture herbicides has increased the importance of this issue for Tennessee's agricultural economy. We are conducting a concentrated effort in herbicide stewardship.

Results

If successful in preventing the loss of 5 percent of the acreage of each crop, this will result in savings to Tennessee's agricultural economy of \$5.1 million.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
213	Weeds Affecting Plants

Outcome #16

1. Outcome Measures

Olive production in Tennessee? (Ownley)

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)

Growers interested in high value crops who have experience with fruit and tree crops, such as blueberries, but want to diversify their farming operations may want to consider olives.

What has been done

In the past 10 years, consumption of olive oil has tripled in the U.S due to its reported health benefits. U.S. consumption is now 10% of world production, while the U.S. only produces 1.3% of our olive oil consumption. Clearly there is room for growth of this commodity in the U.S.

Results

We have shown that cold hardy olive trees can be established (3-yr-period) in the climate of East Tennessee.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
607	Consumer Economics

Outcome #17

1. Outcome Measures

Organic initiative (Wszelaki)

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

The five-year UT-TDA Organic Initiative was officially and successfully completed.

Results

In those five years, we conducted over 170 educational events reaching over 8,000 people. The OSCP website has reached over 43,000 clients since its inception in 2009, with nearly 25,000 clients in Tennessee. The number of certified organic operations in TN more than doubled since the start of the initiative in 2008. The UT Organic and Sustainable Crop Production Program was recognized as one of the Top 6 Land-grant University Organic Programs in the country.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants

215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems
312	External Parasites and Pests of Animals

Outcome #18

1. Outcome Measures

Rose rosette virus (Windham)

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)

Rose rosette is a virus disease that has destroyed hundreds of thousands of roses in the mid-south in the last 10 years. Since there are not management plans for this disease, rose rosette often destroys whole gardens or planting of roses once it is found in a garden.

What has been done

We have identified two management strategies that allow people growing roses to be able to manage this disease and save their plantings of roses.

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
212	Pathogens and Nematodes Affecting Plants

Outcome #19

1. Outcome Measures

Taro Leaf Blight pathogen (Lamour)

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)

Our goal was a better understanding of diversity for the Taro Leaf Blight pathogen (*Phytophthora colocasiae*) across the Pacific region.

What has been done

We, unexpectedly, found a few clonal lineages were responsible for most of the epidemics in China, Vietnam and Hawaii.

Results

This is allowing taro breeders to focus their efforts on developing new lines of taro able to withstand attack of the most virulent lineages.

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)
205	Plant Management Systems
212	Pathogens and Nematodes Affecting Plants

Outcome #20

1. Outcome Measures

Better timing of pesticide applications (Klingeman)

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)

Trap design and seasonal flight activity of economic pests can help us improve our pesticide applications.

What has been done

We continue to optimize traps and develop seasonal flight profiles of economically important nursery and landscape pests, including metallic wood boring beetle, clearwing moth, long-horned beetle, and ambrosia beetle species common across the eastern U.S.

Results

Collaborative research efforts remain focused on improving trap designs, kairomone attraction profiles and direct monitoring of walnut twig beetle seasonal flights.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
211	Insects, Mites, and Other Arthropods Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems

Outcome #21

1. Outcome Measures

Using genetics against Phytophthora blight (Lamour)

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)

Phytophthora (the plant-destroyer) is a plant-damaging water mold that causes enormous worldwide economic losses to crops.

What has been done

For our ongoing vegetable blight project we developed new markers and applied them to populations of *P. capsici* across all of China.

Results

This revealed that long-lived clonal lineages are responsible for much of the annual damage to pepper and providing crucial information to pepper breeders.

4. Associated Knowledge Areas

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

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

TSU Extension used a series of 12 outreach workshops to improve the cultural practices of small Fruits and Vegetables production program. As a result of the program growers begin to understand the importance and adoption of Good Agricultural Practices on their farms. Other evaluation results revealed that:

- 30% of 60 fruit and/or vegetable producers adopted a season extension practices includes row covers, high tunnels, greenhouses, and/or plastic mulches
- 40% of 60 fruit and/or vegetable producers adopted nutrient management program
- 50 % of 40 fruit and/or vegetable producers aware of food safety plan for their farm and begin to adopt in their farm
- 40 % of 25 fruit and/or vegetable producers adopted organic and/or sustainable production practices on their farm
- 60% of 30 growers interested in growing blueberries

Key Items of Evaluation