

V(A). Planned Program (Summary)

Program # 8

1. Name of the Planned Program

Food Safety

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
125	Agroforestry	0%	0%	2%	
205	Plant Management Systems	0%	20%	0%	
311	Animal Diseases	0%	0%	10%	
403	Waste Disposal, Recycling, and Reuse	0%	0%	1%	
501	New and Improved Food Processing Technologies	0%	0%	16%	
502	New and Improved Food Products	0%	0%	6%	
503	Quality Maintenance in Storing and Marketing Food Products	0%	5%	0%	
504	Home and Commercial Food Service	0%	20%	0%	
702	Requirements and Function of Nutrients and Other Food Components	0%	0%	7%	
703	Nutrition Education and Behavior	0%	0%	8%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	100%	5%	32%	
722	Zoonotic Diseases and Parasites Affecting Humans	0%	0%	5%	
806	Youth Development	0%	50%	1%	
901	Program and Project Design, and Statistics	0%	0%	5%	
903	Communication, Education, and Information Delivery	0%	0%	7%	
	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	4.0	0.5	26.0	0.0

Actual Paid Professional	9.0	1.2	40.4	0.0
Actual Volunteer	3.0	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
160033	51704	614246	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
733412	51704	2257714	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
139369	0	2143058	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

In the Safe Food for Tennessee initiative, UT and TSU Extension taught lessons in homes, schools, community centers, churches, and other accessible locations to consumers. The lessons in "Cook's Corner" and "Safe Food for You" were specifically designed to change attitudes, skills and behaviors in regards to safe food handling practices.

Youth participants received food safety education using Fight BAC and other curricula through their school classroom, community center, after-school program, or other locations to reach youth. Direct methods (group meetings, classes, demonstrations, and on-site visits) and indirect methods (newsletters, TV media programs, web sites, newspaper articles and radio programs) emphasized safe food practices:

- using a thermometer to check the internal temperature of food.
- using a thermometer to check the internal temperature of the refrigerator.

We conduct applied and basic research in food-borne risks and nutrition to address high priority issues for consumers of food products. We disseminate information gained from these studies to food industries and consumers through outreach programs, including workshops and educational events at the county level, and through a variety of publications.

Studies are underway on how non-thermal processing (high pressure, ultrasound, solvents) affect the functional properties of proteins for food and non-food applications. Supercritical carbon dioxide will be used to produce biopolymers encapsulation systems for flavors and nutraceuticals and to modify functional properties of proteins.

Research projects in food safety are multi-pronged in their objectives. A major thrust is characterization of the antimicrobial activity of novel natural (i.e., plant-, animal- or microbial-based) compounds and better targeting through controlled-delivery encapsulation systems and incorporation into nanofibers and packaging films. Encapsulation strategies include micelles, liposomes, chitosans, supercritical carbon dioxide, high pressure homogenization and ultrasound. Novel molecular biology strategies are used to identify stress mechanisms in bacteria that allow them to resist interventions.

2. Brief description of the target audience

- Consumers
- Employees of Child Care Centers
- SNAP and WIC clients

3. How was eXtension used?

This Food Safety planned program was enhanced through the service of four Tennessee Extension personnel on the "Food Safety" CoP, including the leader who serves as a specialist in the UT Extension Department of Family and Consumer Sciences. 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	201687	6223443	284652	0

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

Patent Applications Submitted

Year: 2013
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	2	86	88

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of exhibits displayed to promote safe food handling practices.

Year	Actual
2013	12030

Output #2

Output Measure

- Number of research-based publications distributed by Extension to educate producers, processors, and consumers.

Year	Actual
2013	4922298

Output #3

Output Measure

- Developed procedures for fortifying ground coffee with bioactive compounds (Zivanovic)

Year	Actual
2013	0

Output #4

Output Measure

- Created and applied chitosan-gallic acid multifunctional packaging for reduction of oxidation and extension of shelf life of foods susceptible to rancidity. (Zivanovic)

Year	Actual
2013	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Safe Food Handling for Consumers: Number of consumers who more often washed their hands with soap and warm running water before preparing food.
2	Safe Food Handling for Consumers: Number of consumers who now separate raw, cooked, and ready-to-eat foods while storing and preparing.
3	Safe Food Handling for Consumers: Number of consumers who now use a thermometer to check the internal temperature of food.
4	Safe Food Handling for Consumers: Number of consumers who canned vegetables following a tested recipe.
5	Adoption of a homogenization pasteurization process as an alternative to thermal processing by small or mid-sized juice processors (Davidson).
6	If petroleum prices continue to increase, we may identify several applications for chitosan to replace cellulose in the pharmaceutical or plastics industries (Zivanovic).
7	Pending chitosan being granted GRAS (Generally Recognized As Safe) status, our research will lead to applications in edible films and food additives with anti-microbial and thickening properties (Zivanovic).
8	Preserving Foods Safely At Home
9	Finding Salmonella with novel molecular approaches (D'Souza)
10	Genetic markers for mastitis susceptibility (Pighetti)
11	Inactivation of viral pathogens (D'Souza, Davidson)
12	Pet food safety (Zivanovic)
13	Prevent (rather than respond to) food-borne illness (Buchanan, Critzer, Wszelaki, Lockwood)
14	Target leading foodborne human pathogen C. jejuni (Lin)

Outcome #1

1. Outcome Measures

Safe Food Handling for Consumers: Number of consumers who more often washed their hands with soap and warm running water before preparing food.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	11717

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

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

Outcome #2

1. Outcome Measures

Safe Food Handling for Consumers: Number of consumers who now separate raw, cooked, and ready-to-eat foods while storing and preparing.

2. Associated Institution Types

- 1862 Extension
- 1890 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
504	Home and Commercial Food Service
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #3

1. Outcome Measures

Safe Food Handling for Consumers: Number of consumers who now use a thermometer to check the internal temperature of food.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
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2013

1498

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
503	Quality Maintenance in Storing and Marketing Food Products
504	Home and Commercial Food Service

Outcome #4

1. Outcome Measures

Safe Food Handling for Consumers: Number of consumers who canned vegetables following a tested recipe.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	310

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
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503	Quality Maintenance in Storing and Marketing Food Products
504	Home and Commercial Food Service
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #5

1. Outcome Measures

Adoption of a homogenization pasteurization process as an alternative to thermal processing by small or mid-sized juice processors (Davidson).

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)

{No Data Entered}

What has been done

{No Data Entered}

Results

{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
503	Quality Maintenance in Storing and Marketing Food Products
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #6

1. Outcome Measures

If petroleum prices continue to increase, we may identify several applications for chitosan to replace cellulose in the pharmaceutical or plastics industries (Zivanovic).

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

Pending chitosan being granted GRAS (Generally Recognized As Safe) status, our research will lead to applications in edible films and food additives with anti-microbial and thickening properties (Zivanovic).

Not Reporting on this Outcome Measure

Outcome #8

1. Outcome Measures

Preserving Foods Safely At Home

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

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)

Approximately 1 in 5 U.S. households can their own food, and 65% of those households can vegetables. Home canned food poses a risk for foodborne illness if not done safely.

What has been done

In 2013, Extension provided education about home food preservation through classes, news articles, and answering questions from clientele. Extension made 10,662 direct contacts with food

preservation education during 2013; 3.5 million contacts were made using indirect methods such as exhibits, newspaper articles, publications, radio, television, and web sites.

Results

The following impacts were reported:

- ?569 dial-gauge lids were tested.
- ?265 of 286 participants surveyed preserved foods following a tested recipe.
- ?250 of 283 participants process high-acid foods in a water bath canner.
- ?393 of 501 participants surveyed canned pickles following a tested recipe.
- ?392 of 483 participants surveyed canned tomatoes following a tested recipe.
- ?475 of 624 participants surveyed canned vegetables following a tested recipe.
- ?229 of 263 participants surveyed process low-acid foods in a pressure canner.
- ?380 of 506 participants surveyed processed pickles in a water-bath canner.
- ?452 of 585 participants surveyed processed tomatoes in a water-bath or pressure canner.
- ?391 of 508 participants surveyed processed vegetables in a pressure canner.

4. Associated Knowledge Areas

KA Code	Knowledge Area
503	Quality Maintenance in Storing and Marketing Food Products
504	Home and Commercial Food Service
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #9

1. Outcome Measures

Finding Salmonella with novel molecular approaches (D'Souza)

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)

Salmonella and human norovirus outbreaks have been on the rise and novel rapid methods to detect as well as control these outbreaks to provide safe food and prevent outbreaks are needed.

What has been done

Results

Rapid detection using novel molecular approaches (LAMP) that do not require expensive thermocyclers has resulted in significant improvements in detection sensitivity and speed over traditional cultural methods and standard molecular assays such as polymerase chain reaction (PCR). This developed technology has decreased assay time for timely food-product release.

4. Associated Knowledge Areas

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

Outcome #10

1. Outcome Measures

Genetic markers for mastitis susceptibility (Pighetti)

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)

Mastitis, an inflammation of the mammary gland most commonly caused by bacteria, negatively impacts milk safety and represents one of the most economically devastating diseases in the dairy industry.

What has been done

Research from our lab has identified a series of genetic markers for mastitis susceptibility and has the potential to select for cows and sires more resistant to disease, thereby enhancing dairy cow health and safety of the milk supply. By using genetic markers which identify cows resistant or susceptible to infection, we can identify what mechanisms lead to these differences.

Results

Once known, novel strategies can be developed that target these mechanisms and prevent or treat infections in cattle and potentially other species.

4. Associated Knowledge Areas

KA Code	Knowledge Area
311	Animal Diseases
722	Zoonotic Diseases and Parasites Affecting Humans

Outcome #11

1. Outcome Measures

Inactivation of viral pathogens (D'Souza, Davidson)

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)

Norovirus and Hepatitis A virus are responsible for a majority of the foodborne illnesses in the US and can be transmitted through water or foods.

What has been done

Efficacious inactivation strategies for foodborne bacterial and viral pathogens will help curb outbreaks. The producers and food industry will be tremendously benefited by using the results obtained from the research with optimal process times and use of natural antimicrobials to help prevent recalls or allow for timely recalls of product, thus protecting public health and agriculture.

Results

We have determined the thermal inactivation kinetics of norovirus surrogates and Hepatitis A virus in buffer, spinach and blue mussels. This is the first time that the thermal inactivation kinetics of these viruses has been characterized and modeled. Knowing what temperatures and times are required to kill these viruses will assist in improving food safety in the US and globally. Additionally, discovering that HAV is particularly heat resistant may lead to its use as a model for pasteurization.

4. Associated Knowledge Areas

KA Code	Knowledge Area
503	Quality Maintenance in Storing and Marketing Food Products
504	Home and Commercial Food Service
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
722	Zoonotic Diseases and Parasites Affecting Humans

Outcome #12

1. Outcome Measures

Pet food safety (Zivanovic)

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

Results

Analyzed pet food products produced with novel natural antimicrobial compounds for potentially toxic degradation products.

4. Associated Knowledge Areas

KA Code	Knowledge Area
502	New and Improved Food Products
702	Requirements and Function of Nutrients and Other Food Components

Outcome #13

1. Outcome Measures

Prevent (rather than respond to) food-borne illness (Buchanan, Critzer, Wszelaki, Lockwood)

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)

The Food Safety Modernization Act of 2011 emphasizes the prevention of food-borne illnesses rather than responding to outbreaks. In response to this act, the U.S. FDA has developed new regulations regarding the use of surface water during the growing, harvesting, packing, and holding of produce for human consumption. Because irrigation water is one of the most likely points of pathogen contamination, methods are needed that can reliably and economically disinfect irrigation as it is applied to fresh produce.

What has been done

Since 2010, food safety workshops and projects have been conducted across the state to help growers become more familiar with GAPs (Good Agricultural Practices), write their food safety plans to prepare for third party audits, and test their irrigation water quality.

Results

From preliminary results gathered through water testing, UT has evaluated the survival of foodborne illness pathogens from surface water on produce and methods to mitigate the risk of produce contamination from irrigation water. Through the UT food safety programs, over 1,500 growers and agents have been trained and a food safety webpage has been created.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
504	Home and Commercial Food Service
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and

	Naturally Occurring Toxins
722	Zoonotic Diseases and Parasites Affecting Humans
903	Communication, Education, and Information Delivery

Outcome #14

1. Outcome Measures

Target leading foodborne human pathogen *C. jejuni* (Lin)

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)

Campylobacter jejuni is the leading foodborne human pathogen in the United States and many other industrialized countries. Increasing evidence also indicates that antibiotic use in poultry selects for resistant *C. jejuni*, posing a significant threat to public health.

What has been done

Our studies focus on the development of innovative strategies to control *Campylobacter* infection in humans and in animal reservoirs, consequently reducing the occurrence of foodborne illness.

Results

Our studies may open new avenues for treatment and prevention of resistant foodborne pathogens important in animal health and food safety.

4. Associated Knowledge Areas

KA Code	Knowledge Area
311	Animal Diseases
501	New and Improved Food Processing Technologies
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
722	Zoonotic Diseases and Parasites Affecting Humans

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Competing Public priorities
- Competing Programmatic Challenges

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

In 2013, UT and TSU Extension provided education about home food preservation through classes, news articles, and answering questions from clientele. Extension made 10,662 direct contacts with food preservation education during 2013; 3.5 million contacts were made using indirect methods such as exhibits, newspaper articles, publications, radio, television, and web sites. The following impacts were reported:

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Key Items of Evaluation

In 2013, UT and TSU Extension provided education about home food preservation through classes, news articles, and answering questions from clientele. Extension made 10,662 direct contacts with food preservation education during 2013; 3.5 million contacts were made using indirect methods such as exhibits, newspaper articles, publications, radio, television, and web sites. The following impacts were reported:

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