

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Food Safety - contaminant-free, healthier foods

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
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources				50%
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins				50%
	Total				100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	8.6
Actual Paid	0.0	0.0	0.0	5.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	253817
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	253817
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Identify risk factors for cross contamination by investigating storage practices of refrigerated foods. Determine the likelihood and mechanisms of cross contamination by mapping the genetic fingerprints of bacteria strains from the same refrigerator.
 Change potentially unsafe consumer practices through effective intervention strategies.
 Characterize, analyze, and identify antibiotic-resistant bacteria in the farm environment (animal manure, soil) and irrigation water.
 Train students on isolation and characterization techniques for foodborne pathogens in fresh produce and the farm environment.
 Develop and deliver educational materials on hygienic agricultural practices needed to reduce the use of antibiotics and safe fresh produce handling practices.
 The development, maintenance, and revision of an educational website and brochure on safe fresh produce handling practices and judicious use of antibiotic in agriculture.

2. Brief description of the target audience

Fresh produce farmers, consumers, food scientists, food production industry, households in the metropolitan Nashville area.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	35	55	0	0

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

Patent Applications Submitted

Year: 2014
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
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Actual	1	1	2
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V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Website developed to educate consumers on antibiotic resistant pathogens on fresh produce.

Year	Actual
2014	1

Output #2

Output Measure

- Database of characterized antibiotic resistant microorganisms isolated from animal manure.

Year	Actual
2014	1

Output #3

Output Measure

- Database of characterized antibiotic resistant microorganisms isolated from irrigation water and watersheds.

Year	Actual
2014	1

Output #4

Output Measure

- Factsheets on improvement of kitchen cleanliness and prevention of cross-contamination.

Year	Actual
2014	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Consumers will be educated via booklets on the occurrence and prevention of antibiotic resistant pathogens on fresh produce (Increase adoption of recommended safe food handling practices at the individual, family, community, production, and supply system levels.)
2	Producers will practice judicious use of antibiotics on farms through improved agricultural practices (Increase adoption of recommended safe food handling practices at the individual, family, community, production, and supply system levels).
3	Consumers will practice safe fresh produce handling practices via food safety education (Increase adoption of recommended safe food handling practices at the individual, family, community, production, and supply system levels).
4	Consumers will have increased knowledge of improved kitchen cleanliness (Increase adoption of recommended safe food handling practices at the individual, family, community, production, and supply system levels).
5	Consumers will have increased knowledge of means to reduce the chance of cross contamination (Increase adoption of recommended safe food handling practices at the individual, family, community, production, and supply system levels).
6	Consumers will adopt safer food storage practices (Increase adoption of recommended safe food handling practices at the individual, family, community, production, and supply system levels).
7	Consumers will adopt improved cleaning skills (Increase adoption of recommended safe food handling practices at the individual, family, community, production, and supply system levels).

Outcome #1

1. Outcome Measures

Consumers will be educated via booklets on the occurrence and prevention of antibiotic resistant pathogens on fresh produce (Increase adoption of recommended safe food handling practices at the individual, family, community, production, and supply system levels.)

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	9

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

A majority of consumers have become increasingly aware of the risks of foodborne pathogens associated with fresh produce; more concern especially if the pathogens were antibiotic resistant. Data obtained in this study will be used to educate on risks of using contaminated irrigation water, animal manure, and safe handling practices. Consumers, who adopt to food safety practices, reduce the risks of cross contaminating their fresh produce.

What has been done

Research was conducted to determine current practices of produce production, manure application, waste management, source of irrigation water, personal hygiene, and water testing for pathogens, harvesting containers, and produce handling and storage. Individual farms were analyzed for water quality for irrigation, harvesting containers, sanitizing and harvesting equipment, personal hygiene/hand washing/toilet. Produce growers were also trained on pre- and post- harvesting handling procedures, manure management, and recording keeping of farm operation and log sheets for daily activities.

Results

Results provided valuable information to support food safety on the farm, as well as educational efforts to increase awareness and knowledge of possible bacterial contamination of fresh produce. A follow up on analysis revealed that 80% of the farms had records to show farm activities. Produce growers showed increased knowledge on how to limit contamination of produce during harvesting and the significance of using composted manure on the farms. Growers indicated that they were also having their irrigation water tested for microbial

contamination.

4. Associated Knowledge Areas

KA Code	Knowledge Area
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #2

1. Outcome Measures

Producers will practice judicious use of antibiotics on farms through improved agricultural practices (Increase adoption of recommended safe food handling practices at the individual, family, community, production, and supply system levels).

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	4

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Antibiotic resistant foodborne pathogens in fresh produce may cause personal distress, preventable death, and avoidable economic burden. Profiles of antibiotic resistant bacteria obtained from animal manure and irrigation water is applied to educate growers the importance of judicious use of antibiotics in the fields. This contributes to the efforts in reducing the prevalence of antibiotic resistant bacteria in farms.

What has been done

Data on profiles and patterns of antibiotic resistant bacteria from fresh produce and the farm environment was collected. A graduate student was recruited and trained to analyze antibiotic resistant bacteria contaminating fresh produce. Farmers were educated on prudent use of antibiotics on farms and how bacteria resistance is attributed to the overuse and misuse of antibiotics in animal agriculture.

Results

Bacteria isolated from the farm environment showed resistance to the following: antibiotics ciprofloxacin, colistin, streptomycin, and tetracycline. One graduate student became more versed with the food safety issues relating to fresh produce and had hand-on experience in characterizing antibiotic resistant bacteria from farm environment. A significant percentage of producers farmers indicated they only administered antibiotic treatment only when it was needed and as directed by a veterinarian.

4. Associated Knowledge Areas

KA Code	Knowledge Area
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #3

1. Outcome Measures

Consumers will practice safe fresh produce handling practices via food safety education (Increase adoption of recommended safe food handling practices at the individual, family, community, production, and supply system levels).

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	7

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Contaminated produce is a risk to the public. This is an increased concern now, because more consumers have increased consumption of raw greens in their diets due to increased knowledge of the health benefits of consumption of raw greens.

What has been done

Research information on how to reduce/limit contamination during food preparation was delivered to extension personnel. The focus of the information was the handling of raw meats and fresh produce during food preparation.

Results

Analyses indicated positive consumer behaviors when handling fresh produce and raw meats.

4. Associated Knowledge Areas

KA Code	Knowledge Area
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #4

1. Outcome Measures

Consumers will have increased knowledge of improved kitchen cleanliness (Increase adoption of recommended safe food handling practices at the individual, family, community, production, and supply system levels).

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	7

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Cross-contamination during food handling, preparation, and storage is one of the major contributing factors in the transmission of foodborne diseases at home. Improving the effectiveness of microbiological control measures in home kitchens is crucial in preventing foodborne diseases.

What has been done

Research was conducted on microbiological evaluation of swab samples collected from consumer home refrigerators. Information on consumer cleaning practices was collected through analysis of data obtained from in-person interviews and in-home observations. The importance and effective procedures of cleaning refrigerator to control microbiological contamination in home refrigerators were discussed with target consumers during home visits.

Results

Results indicate that consumers who clean their refrigerators regularly had significantly lower bacteria contamination on the refrigerator shelves. Target consumers have learned proper cleaning methods to improve refrigerator cleanliness.

4. Associated Knowledge Areas

KA Code	Knowledge Area
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #5

1. Outcome Measures

Consumers will have increased knowledge of means to reduce the chance of cross contamination (Increase adoption of recommended safe food handling practices at the individual, family, community, production, and supply system levels).

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	30

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Home refrigerators can harbor pathogenic bacteria that pose a potential to contaminate stored foods. Consumers should be informed about safe handling of refrigerated foods to reduce the risk of food contamination.

What has been done

Analysis of in-home research observations were conducted to determine situations that may cause contamination of stored foods. Research results concerning proper storage of refrigerated foods was discussed with the target consumers during home visits.

Results

Research data collected informed consumers of potential issues in their refrigerators that may cause contamination to the foods and the proper storage of refrigerated foods to reduce the

chances of cross contamination.

4. Associated Knowledge Areas

KA Code	Knowledge Area
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #6

1. Outcome Measures

Consumers will adopt safer food storage practices (Increase adoption of recommended safe food handling practices at the individual, family, community, production, and supply system levels).

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	27

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Cross-contamination during food preparation and storage is one of the major contributing factors in the transmission of foodborne diseases. Many foods, such as raw poultry, meat, eggs, fish, shellfish, fruits and vegetables have been cited as the potential contamination sources of foodborne pathogens. Proper food handling and storage practices by consumers will reduce the risk of foodborne illness at home.

What has been done

Follow-up analyses were conducted with the consumers who had participated in the prior in-home food storage data collections. Data pertaining to the adoption of the recommended food storage practices were collected.

Results

Improvement of refrigeration storage was assessed by the follow-up analysis. Results indicated that most (88%) of the target consumers reported improvements in their storage practices.

4. Associated Knowledge Areas

KA Code	Knowledge Area
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #7

1. Outcome Measures

Consumers will adopt improved cleaning skills (Increase adoption of recommended safe food handling practices at the individual, family, community, production, and supply system levels).

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	23

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Consumer hygiene practices have been frequently reported to be inefficient in controlling bacterial growth and survival in the kitchen environment. Practice of effective cleaning methods by consumers will reduce microbial contamination in home kitchens.

What has been done

Follow-up analyses were conducted by phone with the consumers who had participated in the prior data collections. Data were gathered regarding the adoption of the recommended cleaning practices.

Results

The improvement of refrigeration cleaning practices by consumers was assessed by the follow-up interviews. Results indicate that almost all (92%) of the target consumers reported improvements in their cleaning practices.

4. Associated Knowledge Areas

KA Code	Knowledge Area
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The success of this project was tracked by:

- Increased number of produce growers and farmers in knowledge gained on how to avoid cross contamination during planting and harvesting periods,
- Understanding concepts on the implementation of farm record keeping in individual farms. The farmers indicated that they only administered antibiotic treatment only when it was needed and as directed by a veterinarian. Four farms implemented farm record keeping.
 - Number of target consumers adopting safer food storage practices
 - Number of target consumers adopting improved cleaning skills
 - Number of students trained in research.

Produce growers and consumers were reluctant to participate in the surveys and frequently felt that farm and household information should be confidential and they did not want to share. Produce growers were also reluctant to allow the researchers visit their farm to collect samples for microbial analysis.

This program influenced consumers on safe handling practices of fresh produce during meal preparations at home. Produce growers were educated on how to reduce/control antimicrobial on their farms. This ensures food safety and quality for fresh fruits and vegetables in farms.

Of the target consumers, 88% reported taking safety measures to prevent cross contamination when storing raw meat and poultry in their refrigerators; and 92% reported an increase of frequency in cleaning refrigerator and checking refrigerator temperature. Two students were trained in performing the analytical procedures and have gained knowledge and experiences in performing food safety interview and observation.

Key Items of Evaluation