

**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
102	Soil, Plant, Water, Nutrient Relationships	5%		5%	
104	Protect Soil from Harmful Effects of Natural Elements	5%		5%	
311	Animal Diseases	0%		15%	
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals	0%		15%	
404	Instrumentation and Control Systems	0%		10%	
501	New and Improved Food Processing Technologies	15%		15%	
502	New and Improved Food Products	10%		0%	
503	Quality Maintenance in Storing and Marketing Food Products	10%		0%	
504	Home and Commercial Food Service	20%		5%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	10%		10%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	10%		10%	
722	Zoonotic Diseases and Parasites Affecting Humans	0%		10%	
723	Hazards to Human Health and Safety	15%		0%	
	<b>Total</b>	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	3.0	0.0	4.0	0.0

Actual Paid Professional	5.8	0.0	4.4	0.0
Actual Volunteer	12.0	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
137101	0	281124	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
492156	0	727374	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
137103	0	128140	0

**V(D). Planned Program (Activity)**

**1. Brief description of the Activity**

- Conduct training and certificate programs for growers, producers, food workers, consumers and vendors to increase knowledge of food safety practices.
- Design strategies, tools and processes to detect and eliminate pathogens, chemical and physical contaminants during production, transportation, processing and preparation of food.
- Investigate the ecology of threats to the food supply from microbial and chemical sources
- Develop technologies for the detection of food supply contaminants

**2. Brief description of the target audience**

- Producers
- Processors
- Retail - restaurants/vendors/supermarkets
- Department of Health
- Consumers, families, youth communities
- NJAES - faculty - staff - students
- Food manufacturers
- Schools - child care providers - food service workers

**3. How was eXtension used?**

eXtension was not used in this program

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	12326	16580	197	4487

**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
<b>Actual</b>	1	23	24

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- -New methods in technologies -Educational workshops -Newsletters -Scientific publications - Patents -Website development -Extension publications -Volunteers trained -Agricultural and Industry Certifications -Train the trainer programs -Audits conducted

Year	Actual
2013	0

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Short Term - Increase knowledge of viable technologies, detection prevention, intervention and control technologies and practices to ensure food safety. Increase understanding of the ecology of threats to food safety from microbial and chemical sources.
2	Medium Term - Adoption of safe food handling practices at the individual, family, community, production and supply system levels.
3	Long Term - A safe food supply resulting from reduced incidence of food-borne illnesses.
4	Medium Term - Economic Analysis on Market Responses to Food Scare Events - Adoption of safe food handling practices at the individual, family, community, production and supply system levels.
5	Medium Term - Modeling and Risk Assessment of Food Safety Risks to the Food Supply - Adoption of safe food handling practices at the individual, family, community, production and supply system levels.
6	Medium Term - Role of Foodborne Pathogen Cell Surface Moieties and Plant Defense Systems in Colonization of Crops Intended for Human Consumption. - Adoption of safe food handling practices at the individual, family, community, production and supply system levels.
7	Medium Term - Studies of Pleurocidin, a Natural Antimicrobial Peptide, for Food Applications - Role of Foodborne Pathogen Cell Surface Moieties and Plant Defense Systems in Colonization of Crops Intended for Human Consumption. - Adoption of safe food handling practices at the individual, family, community, production and supply system levels.
8	Medium Term - Development of Functional Biopolymers for Enhancing Food Safety and Quality - Role of Foodborne Pathogen Cell Surface Moieties and Plant Defense Systems in Colonization of Crops Intended for Human Consumption. - Adoption of safe food handling practices at the individual, family, community, production and supply system levels.
9	Medium Term - Quality and Safety of Fresh-cut Vegetables and Fruits - Role of Foodborne Pathogen Cell Surface Moieties and Plant Defense Systems in Colonization of Crops Intended for Human Consumption. - Adoption of safe food handling practices at the individual, family, community, production and supply system levels.
10	Long Term - Shifting Social Norms of Middle School Students with Regard to Food Safety - A safe food supply resulting from reduced incidence of food-borne illnesses.

**Outcome #1**

**1. Outcome Measures**

Short Term - Increase knowledge of viable technologies, detection prevention, intervention and control technologies and practices to ensure food safety. Increase understanding of the ecology of threats to food safety from microbial and chemical sources.

Not Reporting on this Outcome Measure

**Outcome #2**

**1. Outcome Measures**

Medium Term - Adoption of safe food handling practices at the individual, family, community, production and supply system levels.

**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)**

Food Preservation - Canning and Freezing

Interest in home food preservation - canning and freezing ?has increased as more people plant home gardens, participate in CSA's or buy from local farm markets. They want to preserve the extra produce for later in the year. Many people have never preserved food at home and others are using outdated or unsafe recipes and procedures.

**What has been done**

Family and Community Health Sciences Educators in Somerset and Hunterdon County used curricula from the USDA National Food Preservation Center and the Ball Company. The county workshops included demonstration or hands-on practice and video while the Rutgers University Home Gardeners School talk had a power point lecture and video and equipment discussion and display. The Family and Community Health Sciences Educator in Union County at the request from the Westfield Community Supported Agriculture (CSA) group offered a session on safe canning procedures.

**Results**

Participants in the county workshops reported gaining knowledge both in understanding the importance of proper food preservation to ensure safety and the techniques required for a safe and high quality product. Participants planned to preserve food. Canning post workshop evaluation: n=46 responded and reported planned changes in procedures and food preservation techniques. In procedures: 34 almost always only use tested recipes for canning, 39 almost always add lemon juice or citric acid before canning any tomato product, 13 almost always make jelly or jam using paraffin (wax) to seal the jar. In Food Preservation Techniques: 42 plan to can in a water bath canner, 20 plan to can in a pressure canner, 38 plan to can tomato products, 26 plan to can fruit, 19 plan to can vegetables, 21 plan to can pickles, 27 plan to can jam or jelly. Participants in the Westfield CSA session reported improved knowledge by 51% or more from the beginning to the end of class. Knowledge of using a pressure canner and water bath method increased by 82%, understanding acidity of foods increased by 90%, making jams, jellies by 6%, making pickles by 65% and freezing by 62%.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships
104	Protect Soil from Harmful Effects of Natural Elements
311	Animal Diseases
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
404	Instrumentation and Control Systems
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
503	Quality Maintenance in Storing and Marketing Food Products
504	Home and Commercial Food Service
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
722	Zoonotic Diseases and Parasites Affecting Humans
723	Hazards to Human Health and Safety

**Outcome #3**

**1. Outcome Measures**

Long Term - A safe food supply resulting from reduced incidence of food-borne illnesses.

**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)**

Microbial Food Safety for the Fruit and Vegetable Industry

The fruit and vegetable industry is under increased pressure to improve their food safety practices and to obtain a third party audit confirming they are improving their practices. This is even more important with the enactment of the Food Safety Modernization Act which will be implemented over the next several years.

**What has been done**

NJAES researchers, RCE Agriculture Agents, staff and Extension Specialists delivered through the following methods: presentations at produce industry meetings across the state (30-60 minutes), monthly and weekly newsletter articles (Cultivating Cumberland and Statewide Plant and Pest Advisory ? Fruit and Vegetable Editions), website (<http://njveg.rutgers.edu>) where training materials are placed for self training and new food safety information is reported, facebook page (Rutgers Farm Food Safety), in-depth training sessions growers and buyers (4-6 hours), one-on-one critiques of food safety plans on individual farms (mock/second party audit), and webinar presentations.

**Results**

Growers have made major changes to their operation since this program was initiated. As an example, before the food safety program growers packed cilantro and parsley on packinghouse and garage floors. The product was harvested then dumped on the floors; hosed down then packed in boxes. There was no effort to sanitize floors or other packing surfaces. Growers now pack on tables that can be sanitized. Based on our research on possible pathogens in water some growers are installing sanitation systems on their irrigation water lines and sanitizing their packinghouse water. At least 75 operations have passed a third party audit in 2013.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
104	Protect Soil from Harmful Effects of Natural Elements
311	Animal Diseases

314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
404	Instrumentation and Control Systems
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
503	Quality Maintenance in Storing and Marketing Food Products
504	Home and Commercial Food Service
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
722	Zoonotic Diseases and Parasites Affecting Humans
723	Hazards to Human Health and Safety

**Outcome #4**

**1. Outcome Measures**

Medium Term - Economic Analysis on Market Responses to Food Scare Events - Adoption of safe food handling practices at the individual, family, community, production and supply system levels.

**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)**

Economic Analysis on Market Responses to Food Scare Events

The food supply chain that extends from farm to folk faces numerous food safety challenges, including naturally-occurring bacterial pathogen contaminations, intentional and unintentional animal disease outbreaks, and even possible terrorist attacks. Food scare events may have significant socio-economic consequences. According to the Center for Disease Control (CDC), food-borne illness sickens 76 million Americans, causes 325,000 hospitalizations and thousands of deaths, and costs \$44 billion annually. In addition, market responses, including changes in food consumption, the market value of food companies, and futures prices of agricultural commodities, can generate even greater economic loss.

### **What has been done**

NJAES Researcher supervised a G.H. Cook Scholar's honor thesis titled "Consumer Perception and Responses to Different Food Scare Events." The following tasks have been completed: Upon IRB approval, we completed a survey among a focus group consisting 9 Rutgers undergraduates on February 22, 2013; (b) surveys were conducted among Rutgers Undergraduate students in different courses in March, 2013. A total of 200 Rutgers undergraduate students completed the survey; (c) empirical analyses were completed in early April 2013.

### **Results**

The major findings are summarized as follows: (1) Food scare events create a stigma -- consumers are less willing to pay for food products that are involved in a food scare event even if the issue is resolved and the food product is safe for consumption; and (2) the stigma effect targets to the directly-affected food products -- consumers have a negative willingness to pay for products that were directly adversely affected by the food scare events but positive willingness-to-pay for the same products that were not affected.

## **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships
104	Protect Soil from Harmful Effects of Natural Elements
311	Animal Diseases
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
404	Instrumentation and Control Systems
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
503	Quality Maintenance in Storing and Marketing Food Products
504	Home and Commercial Food Service
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
722	Zoonotic Diseases and Parasites Affecting Humans
723	Hazards to Human Health and Safety

## **Outcome #5**

### **1. Outcome Measures**

Medium Term - Modeling and Risk Assessment of Food Safety Risks to the Food Supply - Adoption of safe food handling practices at the individual, family, community, production and supply system levels.

### **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)

Modeling and Risk Assessment of Food Safety Risks to the Food Supply

Use of predictive modeling and quantitative microbial risk assessment tools are gaining increased acceptance both by the food industry and by regulatory agencies. Despite this increased acceptance, the number of academic researchers actively involved in pioneering the use of these tools is very limited.

#### What has been done

NJAES Researcher and Extension Specialist and team of graduate and undergraduate students identify emerging issues that are amenable to study using predictive modeling and risk assessment techniques. Develop predictive models and/or quantitative microbial risk assessments based either on literature data or data collected in our laboratory. We utilize models and risk assessments to educate and inform the industry, as well as inform regulatory policy.

#### Results

Two predictive models and one quantitative microbial risk assessment were developed and published. Sharing of these and other models with policy makers and the food industry was accomplished at meetings, workshops and short courses throughout the reporting period. The first model for the inactivation of *Bacillus coagulans* spores in tomato pulp is significant for three reasons. First it represents an expansion of our work on spoilage organisms by investigating *Bacillus coagulans* for the first time. Second it expands and strengthens our capability to develop models for inactivation of microorganisms, where we have done only limited research. Finally and most importantly, the work strengthens our growing work with Brazilian food scientists. The risk assessment for quantification of aflatoxin risk associated with Chinese spices represents an important accomplishment in two respects. It represents the initiation of a collaboration with Chinese researchers, based in China, a first for our lab. Second, it reflects a broadening of our quantitative risk assessment work from foodborne pathogens to fungal toxins. As China seeks to modernize its food safety system, this work is an important step in the right direction. Given the global nature of the food supply, improving the safety of Chinese spices will have a positive effect worldwide, including US imports of Chinese spices.

## 4. Associated Knowledge Areas

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships
104	Protect Soil from Harmful Effects of Natural Elements
311	Animal Diseases
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
404	Instrumentation and Control Systems
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
503	Quality Maintenance in Storing and Marketing Food Products
504	Home and Commercial Food Service
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
722	Zoonotic Diseases and Parasites Affecting Humans
723	Hazards to Human Health and Safety

**Outcome #6**

**1. Outcome Measures**

Medium Term - Role of Foodborne Pathogen Cell Surface Moieties and Plant Defense Systems in Colonization of Crops Intended for Human Consumption. - Adoption of safe food handling practices at the individual, family, community, production and supply system levels.

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Role of Foodborne Pathogen Cell Surface Moieties and Plant Defense Systems in Colonization of Crops Intended for Human Consumption

The lack of knowledge of foodborne pathogen-plant interaction hinders the development of effective strategies to reduce or eliminate foodborne pathogen contamination of leafy greens and other fresh fruits and vegetables. Sanitizers and sanitizing practices presently employed commercially to reduce microbial numbers on fresh fruits and vegetables post-harvest are not adequate. There exist a real and immediate need to address foodborne-pathogen plant interaction to move forward in the development and initiation of strategies that will enhance the microbial safety of fresh fruits and vegetables.

**What has been done**

NJAES researchers worked to determine the range of bacterial cell surface moieties that induce the plant defense system. The entire *Arabidopsis thaliana* genome has been sequenced. Research is fundamental and mission-linked providing basic knowledge that advances basic and applied research that may be transferred to consumer and industry constituents alike.

**Results**

Experiments have demonstrated that environmental growth factors influence expression of bacteria cell surface moieties and that this, in turn, affects plant defense response. The expression of cell surface moieties including curli and capsule were increased when bacteria were cultured in the presence of manure or soil. Those bacteria were then applied to plants and specific plant defense response factors were monitored. Specifically, the PR2 gene was up-regulated, which influenced population of the target microbe on plant tissue. Growth or holding of bacteria in water had little influence on bacterial cell surface moieties.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships
104	Protect Soil from Harmful Effects of Natural Elements
311	Animal Diseases
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
404	Instrumentation and Control Systems
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
503	Quality Maintenance in Storing and Marketing Food Products
504	Home and Commercial Food Service
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
722	Zoonotic Diseases and Parasites Affecting Humans
723	Hazards to Human Health and Safety

## **Outcome #7**

### **1. Outcome Measures**

Medium Term - Studies of Pleurocidin, a Natural Antimicrobial Peptide, for Food Applications - Role of Foodborne Pathogen Cell Surface Moieties and Plant Defense Systems in Colonization of Crops Intended for Human Consumption. - Adoption of safe food handling practices at the individual, family, community, production and supply system levels.

### **2. Associated Institution Types**

- 1862 Extension
- 1862 Research

### **3a. Outcome Type:**

Change in Action Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Studies of Pleurocidin, a Natural Antimicrobial Peptide, for Food Applications

Every year, food-borne diseases are estimated to affect between 68.7 and 275 million people in the U.S. alone, and cost about \$15 billion in medical care and lost productivity. Food contamination, caused by pathogens in various raw or cooked fish and other foods and food products, affect millions of people annually.

#### **What has been done**

Every year, food-borne diseases are estimated to affect between 68.7 and 275 million people in the U.S. alone, and cost about \$15 billion in medical care and lost productivity. Food contamination, caused by pathogens in various raw or cooked fish and other foods and food products, affect millions of people annually.

#### **Results**

NJAES researchers investigated: 1) the antimicrobial activity of pleurocidin against E. Coli and Listeria and 2), the effect of various proteins on the pleurocidin activity and the minimum inhibiting concentration of pleurocidin against E. Coli with a certain proteins. The results showed that pleurocidin could inhibit the growth of E. Coli and Listeria with MIC of 1.84µg/ml and 34.68-69.36µg/ml respectively. More importantly, all four chosen proteins (BSA, β-lactoglobulin, Albumin from egg white and Gelatin from bovine skin) showed different influence on the reduction of antimicrobial activity of pleurocidin. With proteins of 12mg/ml, pleurocidin represented different minimum inhibiting concentration against E. Coli. Based on these result, we have revealed that the efficacy of Pleurocidin may be reduced because pleurocidin interacted with

various proteins from food. This unexpected important finding is critical for the antimicrobial peptide (e.g. pleurocidin) application. Therefore, we need to investigate the mechanism of these types of interaction and possible ways of remediation immediately.

#### 4. Associated Knowledge Areas

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships
104	Protect Soil from Harmful Effects of Natural Elements
311	Animal Diseases
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
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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
722	Zoonotic Diseases and Parasites Affecting Humans
723	Hazards to Human Health and Safety

#### Outcome #8

##### 1. Outcome Measures

Medium Term - Development of Functional Biopolymers for Enhancing Food Safety and Quality - Role of Foodborne Pathogen Cell Surface Moieties and Plant Defense Systems in Colonization of Crops Intended for Human Consumption. - Adoption of safe food handling practices at the individual, family, community, production and supply system levels.

##### 2. Associated Institution Types

- 1862 Extension
- 1862 Research

##### 3a. Outcome Type:

Change in Action Outcome Measure

##### 3b. Quantitative Outcome

<b>Year</b>	<b>Actual</b>
2013	0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Development of Functional Biopolymers for Enhancing Food Safety and Quality

Food-borne diseases are estimated to affect between 68.7 and 275 million people in the US alone and cost about \$15 billion in medical care and lost productivity.

#### What has been done

NJAES Researchers work leveraging the research progress obtained from our laboratory to capture the new research opportunities in functional biopolymers and synthetic-biopolymers with controlled release properties useful for enhancing food safety and quality.

#### Results

Produced controlled release films containing mixed tocopherols using the blown film process, the cast film process, and the smart blending process. Analyzed the microstructure of these films using scanning electron microscopy, and quantified the release of mixed tocopherols from the films using the HPLC method developed. Developed a new concept called "target release rate" which is an important missing link necessary for applying this technology to the real world. Developed an innovative self-generating CIO2 packaging system using the biopolymer PLA and demonstrated its ability to greatly inhibit microbial growth in fresh tomatoes. Demonstrated that the combination of vapor phase AIT and modified atmosphere could effectively inhibit the growth of aerobic spoilage and pathogenic microorganisms in fresh catfish fillet, thereby extending the shelf life and increasing the microbial safety of this and other similar products. This study provides encouragement to encapsulate AIT into a suitable packaging biopolymer and use the biopolymer to develop modified atmosphere package to enhance the microbial safety of fresh seafood.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
104	Protect Soil from Harmful Effects of Natural Elements
311	Animal Diseases
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
404	Instrumentation and Control Systems
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
503	Quality Maintenance in Storing and Marketing Food Products
504	Home and Commercial Food Service
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
722	Zoonotic Diseases and Parasites Affecting Humans
723	Hazards to Human Health and Safety

## **Outcome #9**

### **1. Outcome Measures**

Medium Term - Quality and Safety of Fresh-cut Vegetables and Fruits - Role of Foodborne Pathogen Cell Surface Moieties and Plant Defense Systems in Colonization of Crops Intended for Human Consumption. - Adoption of safe food handling practices at the individual, family, community, production and supply system levels.

### **2. Associated Institution Types**

- 1862 Extension
- 1862 Research

### **3a. Outcome Type:**

Change in Action Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Quality and Safety of Fresh-cut Vegetables and Fruits

As consumers opt for more food choices that feature both nutrition and convenience, pre-cut fruits and vegetables have become more prevalent in the produce section of food markets. Minimal processing of fruits and vegetables reduces shelf life and makes it easier for human pathogens to infest food.

#### **What has been done**

During 2012-2013, extensive research was conducted to discern whether these storage conditions are applicable for asparagus spears harvested under different strategies to extend the window of harvest.

#### **Results**

It was found that the respiration rates of spears harvested from all mother stalk treatments were, on average, 50% of conventional harvest, as determined from rate studies of headspace gas compositional changes. Therefore, a ratio of .04 micropores per gram is more conducive to maximum pre-cut shelf life and spear quality. The respiration rates of pre-cut spears from extended conventional and mid-season clear cut were not significantly different than the conventional harvest controls. These results will be crucial for practitioners that produce and market pre-cut asparagus spears for an extended period using both conventional and mother stalk harvesting methods.

#### 4. Associated Knowledge Areas

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships
104	Protect Soil from Harmful Effects of Natural Elements
311	Animal Diseases
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
404	Instrumentation and Control Systems
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
503	Quality Maintenance in Storing and Marketing Food Products
504	Home and Commercial Food Service
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
722	Zoonotic Diseases and Parasites Affecting Humans
723	Hazards to Human Health and Safety

#### **Outcome #10**

##### **1. Outcome Measures**

Long Term - Shifting Social Norms of Middle School Students with Regard to Food Safety - A safe food supply resulting from reduced incidence of food-borne illnesses.

##### **2. Associated Institution Types**

- 1862 Extension
- 1862 Research

##### **3a. Outcome Type:**

Change in Condition Outcome Measure

##### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

##### **3c. Qualitative Outcome or Impact Statement**

###### **Issue (Who cares and Why)**

Shifting Social Norms of Middle School Students with Regard to Food Safety

Little attention has been given to children and teens' understanding of safe food handling knowledge and skills, despite their interests in studying food safety and preparing food, growing food shopping and preparation responsibilities, and future roles as caregivers for infants, young children, and elderly parents.

**What has been done**

The Don't Be Gross, a video based social marketing campaign, was developed in collaboration with New Mexico State University and implemented in 5 states (NJ, NY, TX, MN, OH) and evaluated in 17 schools, to promote improved food safety behaviors of middle school youth and to determine the feasibility of disseminating the videos through peer networks and their effects on food safety attitudes, perceived social norms and behaviors of youth.

**Results**

The experimental group completed the following activities at about one week intervals: pretest, viewed video snacks, posttest and follow-up test. The control group completed the same activities at similar intervals but did not have access to the video snacks until after the follow-up test. Linear mixed-effects models, controlling for grade and gender revealed significant time by group effects for participants' perceived susceptibility to foodborne illness; intentions to perform recommended food safety behaviors approached significance. Additionally, compared to the pretest, the experimental group perceived their friends as being significantly more confident in performing food safety behaviors at post- and follow-up tests. Google analytic data revealed that the bounce rate for the main home page of the videos was low suggesting that the video snacks were engaging. The Don't Be Gross videos were well received by youth and shared amongst their peers and may have the potential to promote positive food safety behaviors and intentions among youth.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships
104	Protect Soil from Harmful Effects of Natural Elements
311	Animal Diseases
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
404	Instrumentation and Control Systems
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
503	Quality Maintenance in Storing and Marketing Food Products
504	Home and Commercial Food Service
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
722	Zoonotic Diseases and Parasites Affecting Humans
723	Hazards to Human Health and Safety

## **V(H). Planned Program (External Factors)**

### **External factors which affected outcomes**

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

### **Brief Explanation**

None to report.

## **V(I). Planned Program (Evaluation Studies)**

### **Evaluation Results**

NJAES research and extension outcomes related to this planned program were evaluated utilizing a variety of evaluation methods appropriate for each initiative to determine effectiveness on both a qualitative and quantitative level. For KASA and practice change we included the measurement of knowledge gained as measured by pre/post Likert-scale assessments. Surveys were used to measure increase in skills acquired, behavior change and practice adoption. For process evaluation we focused on program delivery, participation, relevance and timeliness. Data was collected at appropriate times for each initiative that supports this planned program. IRB approved evaluation instruments were used to collect research and extension data. Data analyses and comparisons relevant to basic and applied research and demonstration were collected and analyzed and reported utilizing a variety of data collection methods appropriate to each research question.

The major goal of evaluating is the demonstration of social, economic, behavior and environmental changes in conditions that contribute to improved quality of life as a result of participation in programs and benefits of research solutions. See state defined outcomes for detailed results of each initiative.

### **Key Items of Evaluation**

None to report.