V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Food Safety

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

<table>
<thead>
<tr>
<th>KA Code</th>
<th>Knowledge Area</th>
<th>%1862 Extension</th>
<th>%1890 Extension</th>
<th>%1862 Research</th>
<th>%1890 Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>501</td>
<td>New and Improved Food Processing Technologies</td>
<td>0%</td>
<td>25%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>502</td>
<td>New and Improved Food Products</td>
<td>0%</td>
<td>30%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>503</td>
<td>Quality Maintenance in Storing and Marketing Food Products</td>
<td>20%</td>
<td>10%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>702</td>
<td>Requirements and Function of Nutrients and Other Food Components</td>
<td>0%</td>
<td>15%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>712</td>
<td>Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins</td>
<td>60%</td>
<td>20%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>806</td>
<td>Youth Development</td>
<td>20%</td>
<td>0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

<table>
<thead>
<tr>
<th>Year: 2011</th>
<th>Extension</th>
<th>Research</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1862</td>
<td>1890</td>
</tr>
<tr>
<td>Plan</td>
<td>2.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Actual Paid Professional</td>
<td>0.7</td>
<td>0.0</td>
</tr>
<tr>
<td>Actual Volunteer</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)
1. Brief description of the Activity

Research activities in 2011 included work to determine the etiology, biology, and epidemiology of the bacterial spot to develop effective management strategies for the disease [since there is very little known about this bacterial spot disease, this investigation is essential to assure that the pumpkin industry will continue to be a significant component of the Illinois agricultural economy]; a study of the beneficial and adverse effects of natural, bioactive dietary chemicals on human health and food safety; efforts to reduce losses to the dairy industry caused by mastitis through the study of micro-RNA expression data from mammary tissue; development of a laboratory-scale continuous flow manothermosonication [MTS] system [an enabling system that can be used in maximized microbial inactivation as well as enzyme inactivation tests to ensure food quality]; and experiments to determine the water barrier properties of zein-oleic acid films.

Conference presentations in 2011 included the American Society for Biochemistry and Molecular Biology, American Society for Nutrition, Experimental Biology, and the American Chemical Society.

Food safety training for employees and volunteers that prepare or serve food to the public was delivered at a significantly reduced level this year while searches were launched to fill Extension educator positions. Approximately 100 individuals were trained primarily through the first of the following three programs: [1] the Illinois Department of Public Health five-hour Refresher Course for Food Handlers designed for food service sanitation managers who must maintain their certification every three years; [2] a fifteen-hour Food Services Sanitation Manager’s Certification Course for those seeking initial certification; and [3] Serve it Safely, a food class for volunteers who serve food for fundraisers, community organizations, and family events. A major effort was made to develop and expand evaluation tools for completion by those participating in food safety training. A follow-up survey was modified to address the 2008 Illinois Food Service Sanitation Code changes and is described in more detail in the outcomes and evaluation sections.

The Supplemental Nutrition Assistance Program-Education [SNAP-Ed] staff has emphasized teaching proper hand-washing to youth as well as cleanliness habits when preparing food. Participation in youth cooking schools that incorporate hand-washing activities was not tracked this past year. The scope was reduced because staff members with responsibility for delivering SNAP-Ed programs were experiencing uncertainty regarding funding and staff relocations. Both areas of uncertainty are now resolved.

During this past year, Extension educators focusing on small farms and local foods met to explore opportunities and plan educational delivery responses as a part of their new role. A team of these
Educators conducted five one-day programs in northern Illinois during the winter and early spring of 2011 to address safe food production and handling in order to ensure that fresh produce is free from contamination by microorganisms that cause foodborne illnesses. Fifty-eight participated in these Enhancing Specialty Food Safety programs and shared information through end-of-meeting and follow-up evaluations designed to gather information on program improvement, knowledge gained, and practices applied. Findings are described in the outcomes and evaluation sections.

2. Brief description of the target audience

Members of the target audience included the general public, farmers, the produce industry, policy makers at the local, state, and federal levels, artisanal chocolate manufacturers, research personnel in academia, government, and the food industry, and Extension educators. Extension programs target youth, certified food handlers, and volunteers who serve food to the public [such as for fundraisers, community organizations, and family events such as reunions and weddings]. In addition, producers of food distributed through local systems are targeted and growing in number as a priority audience.

3. How was eXtension used?

Seeking answers and resources related to food safety.

V(E). Planned Program (Outputs)

1. Standard output measures

<table>
<thead>
<tr>
<th></th>
<th>2011 Direct Contacts Adults</th>
<th>2011 Indirect Contacts Adults</th>
<th>2011 Direct Contacts Youth</th>
<th>2011 Indirect Contacts Youth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual</td>
<td>814</td>
<td>665</td>
<td>429</td>
<td>0</td>
</tr>
</tbody>
</table>

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

Patent Applications Submitted

Year: 2011
Actual: 2

Patents listed

Enhanced Fermentation Of Cellodextrins And B-D-Glucose [TF10182-PRO], Biopolymer Microfluidic Devices And Methods Of Manufacture [TF11068-PRO]

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

<table>
<thead>
<tr>
<th></th>
<th>2011 Extension</th>
<th>2011 Research</th>
<th>2011 Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual</td>
<td>0</td>
<td>15</td>
<td>15</td>
</tr>
</tbody>
</table>

V(F). State Defined Outputs
Output Target

**Output #1**

**Output Measure**

- Number Of Completed Hatch Projects

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>3</td>
</tr>
</tbody>
</table>

**Output #2**

**Output Measure**

- Number of Individuals Completing Food Safety Certification Required Training

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>100</td>
</tr>
</tbody>
</table>
## V(G). State Defined Outcomes Table of Content

<table>
<thead>
<tr>
<th>O. No.</th>
<th>OUTCOME NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Monitor Proper Temperatures Of Food Served To The Public To Prevent Food-Borne Illnesses</td>
</tr>
<tr>
<td>2</td>
<td>Increase Knowledge of Personal Cleanliness Habits That Prevent the Spread of Disease Through Food</td>
</tr>
<tr>
<td>3</td>
<td>Effective Management Of Bacterial Spot Affecting Pumpkin Production [The Most Valuable Vegetable Industry In Illinois]</td>
</tr>
<tr>
<td>4</td>
<td>Evaluating Storage Impact Of Quality Characteristics Of Dark Chocolate</td>
</tr>
<tr>
<td>5</td>
<td>Developing A Food Safety Intervention To Pasteurize Fruit And Vegetable Juices</td>
</tr>
<tr>
<td>6</td>
<td>Improved Serviceability Of Zein Films By Improving Their Water Resistance And Barrier Properties</td>
</tr>
<tr>
<td>7</td>
<td>Number Of Fresh Food Producers Adopting Practices That Prevent Foodborne Illness Contamination During The Production And Distribution Of Fresh Produce</td>
</tr>
</tbody>
</table>
Outcome #1

1. Outcome Measures

Monitor Proper Temperatures Of Food Served To The Public To Prevent Food-Borne Illnesses

2. Associated Institution Types

● 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>50</td>
</tr>
</tbody>
</table>

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
As of 1999, the Food Service Sanitation Code required Illinois-certified food service sanitation managers to attend food safety training with a minimum of five hours or to complete a re-certification exam to be eligible for re-certification every five years.

What has been done
Workshops on food safety have been conducted statewide by Extension educators who focus on nutrition and wellness. Adjustments in the content were initiated to incorporate the 2008 updates in the Illinois Food Sanitation Service code. Due to staff reductions, only about ten workshops involving about 100 participants were held. The majority participated in the 5-Hour Refresher Course for Food Handlers for recertification of those serving food to the public. Serve it Safely was offered to volunteers and interested individuals that do not require certification status. This year, evaluation tools were updated for Serve it Safely and the 5-Hour Refresher Course for Food Handlers. A follow-up survey of practice changes was developed and mailed to a random sample of the 367 individuals who participated in the classes between June 1, 2009 and May 31, 2010 [the first year of training that incorporated the Code updates].

Results
Surveys were collected from 74 [56.9% response rate] of the 134 participants. Nearly 65% [48 of the 74 respondents] reported adoption of one or more of the eleven safety handling practices as a result of the training with half of the respondents reporting changes in practices related to monitoring the temperature of the food they served as a result of the training. Most frequently mentioned were: [1] checking the thermometer regularly for accuracy and recalibrating when needed; [2] reheating food rapidly to 165 degrees for 15 seconds and holding at 135 degrees or higher; and [3] cooking and reheating micro-waved protein foods 25 degrees higher than the conventional temperature. Additional information on this survey is provided in the evaluation section.
4. Associated Knowledge Areas

<table>
<thead>
<tr>
<th>KA Code</th>
<th>Knowledge Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>503</td>
<td>Quality Maintenance in Storing and Marketing Food Products</td>
</tr>
<tr>
<td>712</td>
<td>Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and</td>
</tr>
<tr>
<td></td>
<td>Naturally Occurring Toxins</td>
</tr>
</tbody>
</table>

Outcome #2

1. Outcome Measures

Increase Knowledge of Personal Cleanliness Habits That Prevent the Spread of Disease Through Food

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Effective Management Of Bacterial Spot Affecting Pumpkin Production [The Most Valuable Vegetable Industry In Illinois]

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>0</td>
</tr>
</tbody>
</table>

3c. Qualitative Outcome or Impact Statement

**Issue (Who cares and Why)**

Illinois is the leading state in pumpkin production in the United States. In 2011, approximately 11,000 acres of jack-o-lantern pumpkins and 14,000 acres of processing pumpkins were produced in Illinois. More than 90% of processing pumpkins produced in the U.S. are grown and processed in Illinois. Since 2005, bacterial spot, caused by Xanthomonas cucurbitae, has been a serious disease of pumpkins in Illinois and other Midwestern states, causing more than 50% fruit rot in some fields. Incidence and severity of the disease increased every year.

**What has been done**

In 2010, bacterial spot was observed in 40 of 50 commercial jack-o-lantern pumpkin fields in Illinois, with 34% of the fruit overall showing the bacterial spot. In 2011, 64 and 46 pumpkin fields
were surveyed in Illinois and other Midwestern states, respectively, to assess the occurrence of the bacterial spot disease. The fields surveyed in Illinois included 53 jack-o-lantern and 11 processing pumpkin fields. The fields outside Illinois include 7, 8, 5, 6, 5, 9, and 6 jack-o-lantern pumpkin fields in Indiana, Iowa, Kansas, Missouri, Nebraska, Ohio, and Wisconsin, respectively. All of the fields were surveyed at harvest time. Bacterial spot was observed in all eight states surveyed. Incidence of the disease [percent fruits with the bacterial spots] was 89%, 82%, and 83% in jack-o-lantern pumpkin fields in Illinois, processing pumpkin fields in Illinois, and jack-o-lantern pumpkin fields in other Midwestern states.

Results
The pumpkin industry is the most valuable vegetable industry in Illinois and several other Midwestern states. Determining etiology, biology, and epidemiology of the bacterial spot will help to develop effective management strategies for the disease. Since there is very little known about this bacterial spot disease, this investigation is essential to assure that the pumpkin industry will continue to be a significant component of the Illinois agricultural economy.

4. Associated Knowledge Areas

<table>
<thead>
<tr>
<th>KA Code</th>
<th>Knowledge Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>712</td>
<td>Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins</td>
</tr>
</tbody>
</table>

Outcome #4

1. Outcome Measures

Evaluating Storage Impact Of Quality Characteristics Of Dark Chocolate

2. Associated Institution Types

● 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>0</td>
</tr>
</tbody>
</table>

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Experiments were conducted addressing the overall hypothesis that changes occur during storage of chocolate that impact lipid polymorph structure and ultimately lead to bloom formation, leading to a significant detrimental change in texture and flavor as indicated by instrumental and human sensory analyses.
What has been done
We have made significant progress on determining storage impact on quality characteristics of
dark chocolate and the role of lipid polymorph transition in chocolate quality. We have also made
significant progress in the evaluation of the impact of different emulsifiers and their role in
polymorph stability in chocolate during storage. We have also conducted two Summer Chocolate
Education Programs for high school students.

Results
Specific details from sensory and instrumental analyses will lead to a better understanding of the
impact of storage and of different emulsifiers on physical, chemical, and structural properties in
dark chocolate, allowing for optimization of quality during storage. This will provide insight into
emulsifier selection for chocolate manufacturing. Artisanal chocolate manufacturers who are not
easily able to conduct this research have been expressing a desire for more of this information.

4. Associated Knowledge Areas

<table>
<thead>
<tr>
<th>KA Code</th>
<th>Knowledge Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>501</td>
<td>New and Improved Food Processing Technologies</td>
</tr>
<tr>
<td>502</td>
<td>New and Improved Food Products</td>
</tr>
<tr>
<td>503</td>
<td>Quality Maintenance in Storing and Marketing Food Products</td>
</tr>
<tr>
<td>806</td>
<td>Youth Development</td>
</tr>
</tbody>
</table>

Outcome #5

1. Outcome Measures

Developing A Food Safety Intervention To Pasteurize Fruit And Vegetable Juices

2. Associated Institution Types

● 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>0</td>
</tr>
</tbody>
</table>

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The long-term goal of the proposed research is to develop a novel and practical food safety
intervention, manothermosonation [MTS], with maximized cavitation activity, to pasteurize fruit
and vegetable juices to achieve a 5-log reduction and at the same time to maintain product
quality.

What has been done
Acoustic cavitation and reducing treatment time with a sonication, pressure, and mild heat combined treatment for maximized microbial inactivation has been proposed as a feasible approach to facilitate ultrasound-assisted liquid food processing operations. We successfully developed a MTS system with stable temperature in both batch and continuous operation modes and applied it to the inactivation of microorganisms. A double-jacketed sonoreactor was designed and fabricated in the MTS system. The temperature in the reactor was controlled by circulating water through a water jacket.

Results
A laboratory-scale continuous flow manothermosonication [MTS] system was developed in this project. It is an enabling system that can be used in maximized microbial inactivation as well as enzyme inactivation tests to ensure food quality. The microbial inactivation tests conducted with the MTS unit prove that ultrasound technology as a new food processing modality may provide a promising alternative to traditional thermal food preservation methods, especially those dealing with liquid food processing.

4. Associated Knowledge Areas

<table>
<thead>
<tr>
<th>KA Code</th>
<th>Knowledge Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>501</td>
<td>New and Improved Food Processing Technologies</td>
</tr>
<tr>
<td>502</td>
<td>New and Improved Food Products</td>
</tr>
<tr>
<td>503</td>
<td>Quality Maintenance in Storing and Marketing Food Products</td>
</tr>
</tbody>
</table>

Outcome #6

1. Outcome Measures

   Improved Serviceability Of Zein Films By Improving Their Water Resistance And Barrier Properties

2. Associated Institution Types

   ● 1862 Research

3a. Outcome Type:

   Change in Action Outcome Measure

3b. Quantitative Outcome

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>0</td>
</tr>
</tbody>
</table>

3c. Qualitative Outcome or Impact Statement
**Issue (Who cares and Why)**

The goal of the proposed research is to increase the serviceability of zein films by improving their water resistance and barrier properties. This work considers the use of drying oils as hydrophobic protective coatings for zein films. Current coating technology relies on the use of toxic heavy metals as catalysts for in situ oil curing. We are proposing the application of ionizing radiation and the use of nanocomposites for safe and effective film treatments that will increase water resistance of films.

**What has been done**

Activities related to this project include conducting experiments on determination of water barrier properties of zein-oleic acid films and analyzing collected data. A second output was the mentoring of three graduate students. Services related to this project include consulting work with industry groups on methods to increase water resistance of paper and other biobased agricultural and packaging films. Products as outcomes of this project include technology development to increase water and grease resistance of biobased films by formulating bionanocomposite coatings containing nanoclays. Prototypes of bionanocomposite coatings were prepared and showed to industry groups. Dissemination activities included hosting visits and holding conferences with industry groups including paper, polymer, and biopolymer manufacturers to promote the use of biobased materials for agricultural and packaging applications.

**Results**

Changes in knowledge as a result of this project include gaining new fundamental knowledge on the application of Fourier-transform infrared spectra to monitor polymerization of drying oils treated by irradiation. Changes in action include an increase in production of biobased polymers resulting from the development of novel and enhanced applications. Changes in conditions include a new awareness among the research and industrial communities of the potential of bionanocomposites to improve performance of biobased films for agriculture and packaging applications.

4. **Associated Knowledge Areas**

<table>
<thead>
<tr>
<th>KA Code</th>
<th>Knowledge Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>501</td>
<td>New and Improved Food Processing Technologies</td>
</tr>
<tr>
<td>502</td>
<td>New and Improved Food Products</td>
</tr>
<tr>
<td>503</td>
<td>Quality Maintenance in Storing and Marketing Food Products</td>
</tr>
<tr>
<td>712</td>
<td>Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins</td>
</tr>
</tbody>
</table>

**Outcome #7**

1. **Outcome Measures**

   Number Of Fresh Food Producers Adopting Practices That Prevent Foodborne Illness Contamination During The Production And Distribution Of Fresh Produce

2. **Associated Institution Types**
3. Outcome Type:
   Change in Action Outcome Measure

3b. Quantitative Outcome

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>14</td>
</tr>
</tbody>
</table>

3c. Qualitative Outcome or Impact Statement

**Issue (Who cares and Why)**

In recent times, the safety of fresh produce has become a growing concern to consumers and the horticulture industry. Contamination of produce by microorganisms that cause foodborne illness outbreaks result in significant associated health costs. In addition, these outbreaks have financial consequences for a given producer as well as other producers in the same industry who incur losses when the public refuses to buy any product associated with a given foodborne illness outbreak. With FDA plans to introduce new rules to regulate the production and handling practices for fresh produce, it is imperative that stakeholders in the food industry become proactive regarding both Good Agricultural Practices [GAPs] and Good Handling Practices [GHPs].

**What has been done**

In response, five one-day Extension educational programs were conducted in Northern Illinois in the winter and early spring of 2011 on safe food production and handling in order to ensure that fresh produce is free from contamination by microorganisms that cause foodborne illnesses. Specific topics addressed in these programs included water usage and water testing, worker health and hygiene, facilities and equipment sanitation, manure handling and field application, and record keeping. More than fifty individuals participated in the conferences, representing specialty crop producers and retailers; including farmers' market managers and vendors, as well as local health officials.

**Results**

An end-of-meeting evaluation form was distributed and collected from 38 of the participants. A second evaluation was also mailed in January of 2012 to all attendees in the five programs who provided an address [52] to identify any of 37 different practice changes resulting from their participation that were implemented during the growing season. Fourteen of the 27 respondents [53%] identified practice changes implemented. Twelve [44%] of the respondents indicated implementing practice changes related to worker health and hygiene. Ten [37%] of the respondents indicated implementing practice changes related to facilities and equipment sanitation. Six [22%] of the respondents indicated implementing practice changes related to water usage. Four [15%] implemented changes in their record keeping. Five [18%] initiated a safety audit and six [2%] created a written food safety plan for their food production enterprise.

Extension has received over $80,000 of additional funding to expand the number of program delivery sites and support costs of food safety audits of the fresh produce producers' operations in the coming three years.
4. Associated Knowledge Areas

<table>
<thead>
<tr>
<th>KA Code</th>
<th>Knowledge Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>712</td>
<td>Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins</td>
</tr>
</tbody>
</table>

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

V(I). Planned Program (Evaluation Studies)

Evaluation Results

A. Enhancing Specialty Food Safety Program Results

An end-of-meeting evaluation form consisting of seven questions was distributed and collected from 26 of the participants in five one-day Enhancing Specialty Food Safety programs. An evaluation was also mailed in January of 2012 to all attendees in the five programs who provided an address [52] to identify any of 37 practice changes resulting from their participation that were implemented during the growing season. A stamped return envelope was provided to each and a second reminder letter and evaluation copy was sent out two weeks after the original mailing. Respondents to the follow-up survey included a total of 27 of 52 attendees that included specialty crop producers and retailers, including farmers' market managers and vendors, as well as local health officials.

Practice changes implemented

Five questions encompassed 37 potential practice changes that were addressed in the programs. The focus areas of the five questions included: [1] water usage and water quality testing; [2] worker hygiene and health; [3] facilities and equipment sanitation; [4] manure handling and application; and [5] record keeping. Respondents were presented with five options for each practice that included 'Did Prior', 'Do as a Result', 'Plan to Do', 'Do Not Plan to Do', and 'Does Not Apply.'

A large number of the practices were checked 'Does Not Apply.' Most [60-80%] of the respondents checked this response in relation to manure handling and application.
practices. None of the respondents checked that they had initiated any of the nine practices related to manure handling and application. Two-thirds of the respondents do not have employees and would have no need to implement changes related to worker health and hygiene or record keeping. However, 14 of the 27 respondents [52%] identified practice changes implemented.

- Six [22%] implemented practice changes related to water usage and water quality
- Twelve [44%] implemented practice changes related to worker health and hygiene
- Ten [37%] implemented practice changes related to facilities and equipment sanitation
- Four [15%] implemented practice changes related to record keeping.

Specific practices most frequently marked as changes by the respondents included: [Number of individuals making the change is indicated following the practice].

- Provide training to help workers understand the importance of personal hygiene [9]
- Prohibit eating or smoking in produce packing houses and provide a separate space [6]
- Cover clean storage bins when not in use [6]
- Clean harvesting bin/aids daily [5]
- Prior to harvest, clean and sanitize all storage facilities [4]
- Test well water twice a year for microbiological quality [4]
- Properly monitor cooling bath temperature [3]
- Emphasize proper hand-washing [3]
- Record dates and results of all water quality tests [3]
- Record worker training dates and content of training [3]
- Monitor produce wash water temperature [2]
- Provide convenient, clean, well-serviced toilet facilities in the field and packing house [2]
- Encourage proper use of disposable gloves on packing lines [2]
- Reassign sick employees to prevent contact with produce [2]
- Remove field soil from harvesting containers/bins prior to moving them into packing areas [2]
- Wash, rinse, and sanitize the packing area, equipment, and floor at the end of each day [2]
- Clean and sanitize trucks and other transportation vehicles before loading [2]
- Monitor the level of chlorine in sanitizing solutions. [2]

An additional six [6] practices have been implemented by at least one respondent. Respondents also described additional practice changes that included re-evaluating pets in the field, keeping plants in fenced-in areas, and improving the wash area layout. Only three practices plus the nine related to manure handling and application were not checked by any respondent.

In addition, 21 of 27 [78%] of the respondents indicated that they planned to implement at least one additional practice change. However, all of the 37 practices were checked as ‘Plan to Do’ by at least one and as many as nine respondents.

With respect to their involvement in an audit of their operation regarding risk management practices, four indicated that they conducted a self-audit and one engaged a third party in conducting the audit. Six respondents [22%] also indicated that they had created a written food safety plan for their food production enterprise.
B. Refresher Course for Food Handlers

In February of 2012, a questionnaire was mailed to collect data verifying whether or not the five-hour Refresher Course for Food Handlers helped participants improve food handling within their establishments. Subjects were selected through list sampling from recertification class rosters for those held between June 1, 2009 and May 31, 2010 [the period encompassing the first year of training that incorporated information related to the 2008 revisions in the Illinois Food Service Sanitation Code]. A total of 134 workshop participants were randomly sampled from a list of 367. Respondents were asked to remain anonymous. A second mailing of the questionnaire was sent to all respondents three weeks following the first letter to remind them to return the questionnaire. Four questionnaires were returned as undeliverable. A total of 74 [56.9%] of those who actually received surveys returned a questionnaire.

Between 30 and 40% of the participants who found the question applicable indicated that as a result of the Refresher Course for Food Handlers training that they now:

- Use double strength sanitizing solutions in spray bottles [37.7% of 61 responding]
- Check thermometers regularly for accuracy and recalibrate [31.4% of 70]
- Chill ingredients for mixed food before combining. [31.1% of 61]

In addition, between 20 and 30% of participants who found the question applicable indicated that they now practice the following as a result of the training:

- Reheat food rapidly to 165 degrees and hold at 135 degrees or higher [28.3% of 60]
- Cook micro-waved protein foods 25 degrees higher than conventional temp [27.1% of 59]
- Use test strips to check the strength of sanitizing solutions daily [26.6% of 64]
- Wear only a plain wedding band or medic alert bracelet during food preparation. [25.8% of 62]

How many improved on one or more practice?

Two-thirds [48 of 74] of the respondents reported adoption of one or more improved food safety handling practices as a result of the training. Of that number, one-half [37 of 74] of the respondents reported adoption of one or more improved food safety practices related to monitoring proper food temperatures. Respondents reported adopting on average between two and three food safety practice behaviors [2.42 practices].

To what extent did participants share what they had learned with others?

Sixty-six or 90% of the respondents indicated they shared what they learned with others. Three out of four times, this was with co-workers. One out of two times, it was with friends or family or volunteers who helped them.

Key Items of Evaluation

A. Enhancing Specialty Food Safety Key Findings

Approximately half of the end-of-program evaluation respondents indicated they had
learned a great deal about enhancing specialty food safety pertaining to preparing for an audit of implementation of safety practices, keeping appropriate records related to these practices, and manure handling and application. A follow-up evaluation gave evidence that food safety practice changes had been implemented by half of the respondents [primarily with respect to providing training for workers on personal hygiene and facilities and equipment sanitation, such as cleaning procedures for storage and harvesting bins]. One-fourth of the respondents initiated an audit of their safety practices and one-fourth created a written food safety plan for their food production enterprise that will reduce their risk of food contamination by microorganisms that cause food borne illnesses. These actions will position the program participants to be in compliance with rules and policies the Food and Drug Administration plans to introduce to regulate the production and handling practices for fresh produce. Extension training is bringing about practice changes to prevent the spread of food contamination, and thus, reducing the risk of consumer foodborne illnesses and their associated health costs. In addition, these safe practices substantially reduce the financial risk to a given producer as well as other producers in the same industry who incur losses when the public refuses to buy any product associated with a given foodborne illness outbreak.

**B. Refresher Course for Food Handlers**

The results of a random follow-up survey with participants in the University of Illinois Extension food safety recertification workshop indicate that this program does more than meet the continuing education requirements for food handlers to remain certified. Two-thirds of the respondents reported improving their actual food handling with between two and three improved behaviors being reported on average. One-half reported improving food temperature monitoring practices and more than one-fourth [26.8%] took steps to reduce cross-contamination. Using conservative estimates based on the number of meals participants reported serving daily [100] and the annual number of food handlers trained on average per year [350], we believe that Extension training has helped to ensure that an estimated 35,000 meals per day are free of contaminants that can cause foodborne illnesses. Based on a March 2010 study funded by the Pew Charitable Trust indicating that the average cost each time someone gets sick from food is about $1,850, this could represent a very significant contribution toward reducing health care costs.