

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Food Safety And Food Security

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
101	Appraisal of Soil Resources	2%		0%	
111	Conservation and Efficient Use of Water	10%		5%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		10%	
205	Plant Management Systems	10%		0%	
216	Integrated Pest Management Systems	5%		0%	
501	New and Improved Food Processing Technologies	0%		10%	
502	New and Improved Food Products	0%		15%	
503	Quality Maintenance in Storing and Marketing Food Products	10%		5%	
603	Market Economics	3%		5%	
701	Nutrient Composition of Food	0%		5%	
702	Requirements and Function of Nutrients and Other Food Components	0%		5%	
703	Nutrition Education and Behavior	0%		10%	
704	Nutrition and Hunger in the Population	10%		10%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	20%		10%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	20%		10%	
806	Youth Development	10%		0%	
	Total	100%		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	7.0	0.0
Actual Paid	0.0	0.0	5.7	0.0
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
654432	0	619860	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
654432	0	619860	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
5254483	0	1853116	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Activities in 2014 included research to determine if various commercially-available salts influence the rate of oxidation in fresh pork, a project that will develop and employ effective methods for the investigation of potent odorants [aroma-active compounds] in foods, food ingredients and various other complex materials, research that will address the following four questions: [1] What are the material conditions that reduce or reproduce household food insecurity?; [2] What are specific interventions that affect transitions into and out of household food insecurity?; [3] What are the spatial differences in food insecurity prevalence?; and [4] What is the anticipated impact of specific policy interventions?, a study with the overall goal of developing and field testing effective fortification technologies that are low-cost, easy to use, and that do not change feeding habits of populations in developing countries [in the Central American region iron deficiency anemia is a major health concern], a study conducted to determine the optimum conditions for combined treatments of ultrasound and mild heat to improve the microbiological safety of alfalfa seeds while maintaining satisfactory germination rates, an effort to model the effect of incorporating hydrolyzed protein into a formulation on the resulting sensory and physical characteristics of a high-protein snack system, and outreach programs designed to provide growers and buyers with up-to-date information to allow them to more efficiently meet market demands associated with organic production, food safety regulations, Farm to School, and extended seasons for production and marketing.

Activities also included a study focused on leveraging the properties of legume protein nano-aggregates to disperse and stabilize fat soluble compounds such as lutein and vitamin D [besides enhanced dispersion, legume protein nanoparticles could add functionality to these vitamins by protecting them from the environment and offering enhanced bioaccessibility and bioavailability], research to improve the safety of Hispanic-style fresh cheeses, the development of a written protocol to reduce the incidence of cork spots and bitter pit in apple fruits, and the generation of high-quality draft genome sequences and genome maps for two Et strains which may promote the identification of virulence factors as well as

determinants of host specificity [this is the first report of genome sequences for Et strains].

Conference presentations included the Center for Advanced Research in Drying, Institute of Food Technologists, American Society of Agricultural and Biological Engineering, First Workshop of the Molecular Basis of Fire Blight, XVI International Congress of Molecular Plant Microbe Interactions, International Congress for Plant Pathology, XIII Weurman Flavour Research Symposium, Brookings Institution, Illinois Specialty Crops, Agritourism, and Organics Conference, and the Illinois Horseradish Growers Association.

Extension's food safety training for employees of establishments and volunteers that prepare or serve food to the public was delivered to nearly 300 individuals primarily through the following four 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] Food handling safety for food bank managers and staff members; [3] **Serve it Safely**, a food class for volunteers who serve food at fundraisers, community organizations, and family events; and [4] A two-hour workshop titled **From Garden Gates to Dinner Plates** that was attended by individuals who were interested in information about the Illinois Cottage Food Operation Law regarding low-risk foods that can be prepared in private homes and sold at Illinois Farmers Markets. New online and supplemental programs entitled **Yes, You Can--Preserve Food Safely** were conducted in a few locations in the summer. The **Supplemental Nutrition Assistance Program-Education [SNAP-Ed]** curriculum for both youth and adults included an emphasis on proper hand-washing and cleanliness habits when preparing food.

During this past year, six **Enhancing Specialty Food Safety** programs were offered to 130 specialty growers in Illinois and addressed safe food production and handling in order to ensure that fresh produce is free from contamination by microorganisms that cause foodborne illnesses.

State and regional Extension crop conferences/clinics and field days reached large numbers of corn and soybean producers with information on fertility and pest management. **Corn and Soybean Classics** [five regional-based meetings] that featured eight faculty presentations on the latest research concerning crop production, pest management, economics, and the interactions among them were attended by 779 producers and agricultural consultants. The multi-state **AGMasters Conference**, a two-day multidisciplinary conference, was attended by 169 who participated in one general session and 12 specialized sessions. **Regional Crop Management Conferences** were held in four locations in 2014 and were attended by 374 registrants. The primary audience was certified crop advisers. Extension of research to the public also included the **Varietal Information Program for Soybeans**, a website and publication that provided information on yield, protein and oil, and disease and pest susceptibility. Annual research farm field days were held on the campus and at all the other University farms located throughout Illinois to showcase the results of research plots to producers.

The **Pest Management and Crop Development Bulletin** is an online series of articles [67 this past year] primarily posted throughout the crop-growing season [early April to mid-August] and additional times in the off-season to report on the current agricultural conditions based on pest management information provided by entomologists, agronomists, and plant pathologists. The 3,807 plant samples diagnosed by the **University of Illinois Plant Clinic** in 2014 were comprised of 771 client submitted plant samples, 1,300 phytosanitary inspection samples and 1,736 client-submitted soybean cyst nematode and corn nematode soil samples. Of this total 84% involved field crops and 35% involved fruit and vegetable crops. Pesticide safety education was conducted using presentations at numerous locations that resulted in 9,164 commercial pesticide applicator certifications and 1,318 private pesticide applicator certifications.

Statewide Extension conferences related to produce production included several multi-state

conferences: the **Southern and Southwestern Tree Fruit Schools, Stateline Fruit and Vegetable Conference**, and the **Southern Illinois Commercial Vegetable School**. Additional Illinois state or regional conferences focused specifically on growing horseradish, small fruits, and strawberries. Extension also provided leadership for the **Specialty, Agritourism and Organic Conference** and distributed 20 issues of **Fruit and Vegetable News** approximately bi-weekly. Aspiring farmers and new growers and agriculture teachers participated in the third annual **Preparing a New Generation of Illinois Fruit and Vegetable Farmers**, a year-long program which features classroom, hands-on, and in-field instruction. This year Extension staff began collected weekly fruit and vegetable prices from 11 farmers markets and posted them on a website created and shared by Kentucky Extension staff to help farmers [especially new farmers] to decide how to price their products. For a second year Extension Educators with assigned responsibility for small farms and local foods education offered **Putting Small Acres to Work**, a one-day program that addressed a variety of topics including local food production that was offered to help people who have only a few acres learn ways that they can put them to use. One hundred ninety individuals [190] attended one of the four programs. In addition, a series of 13 weekly one-hour webinars directed at small farm owners or operators was offered in the winter of 2014 for 453 Illinois residents and 188 residents of 37 other states and Canada who participated in one or more sessions.

Several interdisciplinary efforts among Extension Educators with responsibility for local foods, horticulture, foods and nutrition, community economic development, and/or 4-H development were targeted at supporting community gardens that raised produce to feed the hungry through the **Illinois 4-H Feeding & Growing Our Communities** initiative.

Extension activities that addressed hunger within Illinois were delivered by **Expanded Food and Nutrition Education Program [EFNEP]** staff and **Supplemental Nutrition Assistance Program - Education [SNAP-Ed]** staff members who conducted hands-on activities with children and their parents with limited incomes. These activities include using food stamps, meal planning, wise shopping, and use of food pantries. The **SNAP-Ed** and **EFNEP** staff used the **CATCH** and **SPARK** curricula to educate elementary and preschool students in after-school and summer programs about healthy snacks, good nutrition, and the importance of physical activity. **OrganWise Guys** materials were also used by **SNAP-Ed** and **EFNEP** staff in elementary school classrooms. The curricula used to teach adults included **Eating Smart Being Active** and **Loving Your Family -- Feeding Your Future** that emphasized feeding your family on a budget and preparing meals safely. Nearly 561,000 teaching contacts were made through the **SNAP-Ed** program and 48,148 teaching contacts were made through **EFNEP** this past year.

2. Brief description of the target audience

Members of the target audience included farmers and the fresh produce industry, food industry professionals who work with extruded snack and cereal products, Illinois horseradish growers and scientists as well as dieticians interested in phytonutrient research in horseradish, U.S. food producers, processors, ingredient manufacturers, and flavor companies, researchers in the fields of economics, public health, and nutrition, policy makers charged with improving the well-being of low-income Americans, program administrators overseeing food assistance programs, scientists at peer institutions, officials from USAID, food industry scientists, the international food and nutrition scientific community, members of the general public who have an interest in the delivery of nutrients and nanoencapsulation, supply chain personnel, farmers' market managers, and the U.S. dairy industry. Extension targeted youth, certified food handlers, and volunteers who serve food to the public, producers of food distributed through local systems, producers of commercial fruit and vegetable crops, producers of feedstuffs for livestock, certified crop advisers, and limited resource audiences that are food stamp eligible.

3. How was eXtension used?

Eight Extension staff members are members of various food safety and food security Communities of Practice including Community Nutrition Education; Community, Local, and Regional Food Systems; and Small and Backyard Flocks.

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	88123	291668	32291	0

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

Patent Applications Submitted

Year: 2014
 Actual: 6

Patents listed

TF 10182-US [Enhanced Fermentation of Cellodextrins and B-D-Glucose], TF 11160-US [Enhanced Cellodextrin Metabolism], TF 12192-US [Biosynthesis of Oligosaccharides], TF 13036-US [Stabilized Compositions and Methods of Manufacture], and TF 13045-PRO [Methods and Compositions for Utilizing Mixed Cellulosic Polysaccharides and Derivatives Thereof]. Issued Patents: 8,748,140 [Xylose-Fermenting Microorganism].

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	0	24	24

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number Of Completed Hatch Research Projects

Year	Actual
2014	2

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number Increasing Knowledge Of New Corn And Soybean Crop Management Techniques
2	Number Of Pounds Of Fresh Produce Donated For Consumption By Vulnerable Populations
3	Practices Adopted That Prevent Foodborne Illness Contamination During The Production And Distribution Of Fresh Produce
4	Number Of Food Preparers Reporting Using Proper Time And Temperature Controls
5	Number Of Food Preparers Reporting Taking Steps To Reduce Cross-Contamination
6	Knowledge Gained Through Improving The Availability Of Fresh Fruits And Vegetables To Low-Income Americans
7	Development Of Fortification Technologies For Developing Countries
8	Enhancement Of Microbial Safety In Fresh Produce
9	Number Of Growers, Producers, And Employees Completing GAPS, GMPs, HACCP, Food Safety Certification, And Onfarm BMP Programs To Increase Food Ssafety
10	Commercialization Of High Protein Extruded Snacks
11	Delivering Adequate Nutrition To At-Risk Populations
12	Improving The Safety Of Hispanic-Style Fresh Cheeses
13	Managing Bacterial Wilt In Cucurbits
14	Increased Knowledge Of Fresh Fruit And Vegetable Production Practices
15	Increased Knowledge Of Small Farm Production Options

Outcome #1

1. Outcome Measures

Number Increasing Knowledge Of New Corn And Soybean Crop Management Techniques

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Number Of Pounds Of Fresh Produce Donated For Consumption By Vulnerable Populations

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	5625

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Over 1.9 million Illinois residents are considered food insecure, which means that they do not have regular access to nutritious food. Thirty-eight percent of food insecure households and 34 percent of children in Illinois exceed federal poverty guidelines that would qualify them for food assistance. Those individuals must rely on charities to feed themselves and their families.

What has been done

University of Illinois Extension's Illinois 4-H program members with funding support from a local donor and the Illinois 4-H Foundation are working with the campus-based Illini Fighting Hunger group to expand efforts across the state to empower youth to end hunger in their communities. 4-H members planted community gardens, stocked food pantries, prepared community meals, provided weekend backpack meals, and promoted farmers markets.

Results

In 2014, the lives of 3,316 families in need were positively impacted through the Illinois 4-H Feeding & Growing Our Communities outreach program. Approximately 1,225 4-H youth and adult volunteers donated 8,300 hours of service to improve the lives of the 4,906 youth and 2,684

adults in those families. These volunteers included 193 4-H Teen Teachers who reached an additional 1,801 youth in 1,400 different families from 30 counties. This past summer 4-H partnered with the Illini Fight Hunger campus initiative and packaged nearly 63,000 meals of soy-fortified rice casserole mix using soy textured protein from Illinois farms for distribution to families in need. In addition, more than 5,625 pounds of produce worth \$10,621 was donated to local food pantries and other centers serving families in need. 4-H members and volunteers now have a better understanding of hunger in their communities and how they can improve the lives of residents in need.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
701	Nutrient Composition of Food
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population

Outcome #3

1. Outcome Measures

Practices Adopted That Prevent Foodborne Illness Contamination During The Production And Distribution Of Fresh Produce

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Number Of Food Preparers Reporting Using Proper Time And Temperature Controls

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	82

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Periodic outbreaks of foodborne illnesses have generated public concern about the safety of the food they consume and have serious health consequences for those who eat contaminated foods and economic consequences for individuals who serve fresh or prepared food. In 1999, the Food Service Sanitation Code required Illinois-certified food service sanitation managers to attend food safety training for a minimum of five hours or to complete a re-certification exam to be eligible for re-certification to serve food every five years. The required hours of training have recently been increased to eight [8] hours.

What has been done

Due to changes this year in food safety certification by the Illinois Department of Public Health, only five certification workshops on food safety [5-hour Refresher Course] were conducted this past year by an Extension Educator with nutrition and wellness assigned responsibility. Fifty [50] individuals involved in serving food to the public participated in these programs. In addition, 102 food bank managers and staff members who are involved in distributing food to those in need participated in the program [the program was adjusted to address their unique food handling safety challenges]. Also, more than 60 participated in the Serve it Safely program for volunteers, and 79 participated in the From Cottage Gates to Dinner Plates program focused on food safety related to Farmers' Market regulations.

A pre- and post-test consisting of eight multiple choice items focused on 2008 changes in the updates to the Illinois Food Sanitation Service code was distributed and collected from those in the certification course to measure knowledge change. Additional information and pre-test/post-test items were shared with food bank staff, volunteers, and those interested in selling items at farmers' markets. A follow-up assessment was collected from the Serve It Safely participants. A pre-post evaluation was also administered to those participating in From Cottage Gates to Dinner Plates.

Results

Impact on knowledge of food safety measured by pre- and post-tests scores from participants in the 5-Hour Refresher Course revealed increases in one or more of the eight food safety practices by all but one of 50 participants [98%]. Seventy of the 102 food bank staff members were able to answer at least one post-test question correctly that they were unable to answer correctly on the pre-test. Specific to maintaining proper temperatures of food, 36 [72%] of the Refresher Course participants learned the temperature range [danger zone] when food is most susceptible to the growth of bacteria that cause foodborne illnesses, and 35 [70%] indicated learning that ready-to-eat potentially hazardous foods can be stored in the refrigerator for no more than seven days.

Seventy percent of the respondents to the Serve It Safely programs indicated that they had changed their food handling procedures [most often their hand washing procedure and using a thermometer to check food temperatures]. For From Garden Gates to Dinner Plates 70 of the 79 participants [89%] indicated gaining knowledge of what food is permitted to be made for sale by a Cottage Food operation, labeling requirements, or were able to correctly identify a 'potentially dangerous hazardous food' after the program ended.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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503	Quality Maintenance in Storing and Marketing Food Products
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
806	Youth Development

Outcome #5

1. Outcome Measures

Number Of Food Preparers Reporting Taking Steps To Reduce Cross-Contamination

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Knowledge Gained Through Improving The Availability Of Fresh Fruits And Vegetables To Low-Income Americans

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

Development Of Fortification Technologies For Developing Countries

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The overall goal is to develop and field test effective fortification technologies that are low-cost, easy to use, and that do not change feeding habits of populations in developing countries. In the

Central American region iron deficiency anemia [IDA] is major health concern. Most populations in this region consume tortillas. Thus, fortification of nixtamalized corn for tortillas at the point of wet grinding could be an effective strategy against IDA in rural Central America. This alternative fortification strategy could be incorporated into local products used in emergency relief efforts by USAID. In this branch of the project we continued the development and characterization of an in situ fortification technology for nixtamalized corn tortillas.

What has been done

High Temperature Extrusion Process With External Fluid Delivery System for Creation of Fortified Pellets: An optimized extruded pellet containing high amounts of iron [either NaFeEDTA or ferrous bisglycinate] and made of corn and brown rice [1:1 w/w] was established. A S2 Welly puffing extruder with a single screw, barrel diameter of 41.2 mm, and a circular die hole of 3.1 mm at a rate of 65.6 g/minute was used. The initial temperature was 115 degrees C and increased to a working temperature of 153 degrees C. Fluid delivery of iron sources was achieved using a peristaltic pump at a flow rate of 2 mL/minute. Iron solutions of NaFeEDTA [92.3 mg/mL] or ferrous bisglycinate [137.5 mg/mL] were pumped into the feeding end of the extruder. A single blade cutter set at 450 rpm attached at the end of the die was used to shape pellets into spheres. The content of iron in pellets was 1 ± 0.08 , 300 ± 10 , and 660 ± 10 mg/kg for control, NaFeEDTA, and ferrous bisglycinate respectively. Moisture content of pellets was below 10%. These pellets were used to directly fortify nixtamalized corn kernels [wet] right before grinding with a pilot scale Burr mill.

Incorporation of Fortified Pellets Into Wet Nixtamalized Corn Kernels and Dispersion of Iron in Corn Masa: A nixtamalization and mixing process was established previously but not optimized to obtain clear incorporation of iron. This was due to the addition of iron oxide from the Burr mill. Thus, after several trials using 5 pound batches, a baseline was collected and used for correction of added iron. A protocol for cleaning the equipment was also developed leading to low contamination of nixtamalized corn masa. The incorporation of pellets into nixtamalized corn kernels was evaluated using a kitchen aid to avoid the contamination process and to contrast its variability with the grinding process using the Burr mill. Whole yellow corn [9 kg] was mixed with 1% lime solution at a ratio of 1:3 w/w [maize:lime solution] and cooked in a kettle at 115 degrees C for 120 minutes. Nixtamalized corn was steeped in the kettle for 12 hours reaching final room temperature [24 degrees C]. The alkaline fluid containing the hulls and dissolved starch was decanted and discarded. Nixtamalized corn was removed from the kettle and washed for 10 minutes with DI water and allowed to rest for 5 minutes. Two fortification levels, either 1:20 or 1:40 w/w [pellet:corn kernels], were systematically mixed for 30 seconds in a bucket containing the corn [5 pounds] before grinding. Grinding of materials was accomplished after a single pass through a pilot scale Burr mill [6 inch plate diameter, 5 hp motor] set at 400 rpm. This lasted less than 5 minutes per batch. Corn masa was directly collected into 7.5 L resealable plastic bags as it left the grinder. Samples were not kneaded or mixed. Each bag was placed horizontally and divided into three collection sections [first, middle and last], representing ground material coming out of the mill. Three sub-samples from each collected section were prepared for further analysis. In order to determine how cultural practices can affect the redistribution of iron within the food matrix, remaining nixtamalized fortified masa samples were kneaded for 5 minutes as is customary in Central America. Sample points were collected similarly as described before. Iron content in samples varied across batches, but not across iron types. The variability [RSD%] within batches for both levels was higher than that between batches, ranging from 3 to 21% for ferrous bisglycinate masa and 7 to 19% for NaFeEDTA masa. Both iron dispersed similarly in unkneaded masa samples. Despite the somewhat uneven iron dispersion in masa, after a 5 minute kneading of samples this variability was reduced to less than 10% across all batches and iron formulations.

Results

These results showed a significant change in knowledge. We were able to establish and characterize a high temperature extrusion process for the formation of extruded products containing two commercial and highly bioavailable chelated iron formulations. Also, we were able to show that incorporation of iron fortified pellets into several batches of nixtamalized corn resulted in uniform dispersion of iron in corn masa after a short and customary kneading process. These results support the ability to fortify nixtamalized corn at the point of wet milling without modifying consumption behavior.

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
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population

Outcome #8

1. Outcome Measures

Enhancement Of Microbial Safety In Fresh Produce

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The key to ensuring sprout safety is to have clean seeds. Although seed sprouts are considered a health food by consumers because they are low in fat and calories and high in fiber and antioxidants, the consumption of raw sprouts has been linked to E. coli O157:H7 outbreaks.

Unfortunately, the FDA-recommended calcium hypochlorite wash is unable to achieve a 5-log reduction in the pathogen populations on seeds. Thus, many studies have sought new means to secure sprout safety.

What has been done

A study was conducted to determine the optimum conditions for combined treatments of ultrasound and mild heat to improve the microbiological safety of alfalfa seeds while maintaining satisfactory germination rates. Alfalfa seeds [100 g] were inoculated with E. coli O157:H7 87:23. The inoculated samples [10 g each] were treated with conditions obtained from the Response Surface Methodology [RSM] with three independent variables: temperature [55, 60 and 65 degrees C], ultrasound power level [20, 40 and 60%], and time [1, 3 and 5 minutes]. Twenty combinations of these three variables were performed. The effects were evaluated by counting the E. coli populations on TSAN plates. The germination rates were determined by counting the germinated seeds after 72 hours [24 in the dark and 48 under light]. The correlations between the trial conditions and the microbial count reduction and germination rate were modeled with an RSM polynomial equation.

Results

The determination coefficient [R²] was 97.6% and 96.4% for log reduction and germination, respectively, and the levels of significance were $p < 0.0001$. The effects of temperature and treatment time were significant, while that of sonication power was less so. The optimum conditions to achieve a 5-log reduction of the E. coli population and 90% germination were determined from the overlaid contour plots.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
503	Quality Maintenance in Storing and Marketing Food Products
704	Nutrition and Hunger in the Population
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 #9

1. Outcome Measures

Number Of Growers, Producers, And Employees Completing GAPS, GMPs, HACCP, Food Safety Certification, And Onfarm BMP Programs To Increase Food Safety

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	92

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 horticultural industry. Contamination of produce by microorganisms that cause foodborne illness outbreaks results 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. Since the Food and Drug Administration introduced new rules to regulate 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, six one-day and two online multi-session Extension educational programs were conducted in Illinois in the winter and early spring of 2014 to address safe food production and handling in order to ensure that fresh produce is free from contamination by microorganisms that cause foodborne illness. 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 one hundred thirty individuals participated in the training sessions representing specialty crop producers and others interested in food safety practices.

Results

An end-of-meeting evaluation form was distributed and collected from 130 of the participants. A second evaluation was also mailed in September of 2014 to all attendees in the eight programs who provided an address [119] to identify any of 34 different practice changes resulting from their participation that were implemented during the growing season. Twenty-six evaluations were returned [21.8%]. It should be noted that the low response rate is likely due to mailing the evaluations during the busy growing season in order to meet a grant funding deadline.

Sixteen of the 26 respondents [62%] identified practice changes implemented. Eight [31%] of the respondents indicated implementing practice changes related to water usage for washing and cooling fresh produce and testing water quality. Eight [31%] also indicated implementing practice changes related to facilities and equipment sanitation, cleaning harvesting bins/aids each day, and sanitizing trucks and other transportation vehicles before loading. Seven [27%] of the

respondents indicated implementing practice changes related to worker health and hygiene [such as training their workers about hand washing, posting hand washing signs, and stocking hand washing supplies]. Six [23%] implemented changes in their record-keeping and five [19%] made changes in manure handling and field application. With respect to their involvement in an audit of their operation regarding risk management practices, only two indicated they conducted a self-audit. However, nine [35%] created a written food safety plan for their food production enterprise. In addition, 21 of 26 of the respondents [81%] indicated that they planned to implement at least one additional practice change.

4. Associated Knowledge Areas

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

Outcome #10

1. Outcome Measures

Commercialization Of High Protein Extruded Snacks

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Most traditional snack foods [chips, crackers, puffs] are based on ingredients with high starch content. This is because starch-based ingredients are inexpensive and typically provide a neutral flavor profile suitable for additional flavors. Furthermore, starch-based ingredients compared to protein-based ingredients when used as a base material result in greater expansion of the extrudates, a key for creating acceptable textures in puffed snack foods. Incorporation of hydrolyzed protein blends possesses the potential key to solving the problems found with proteins inhibiting expansion by forming highly-ordered matrices. From the findings from this study, we will

be able to determine the relationship between the degree of hydrolysis of the proteins in the formulation and the physical and sensory characteristics of the resulting high protein snack product, which will further demonstrate the potential for commercialization of high protein extruded snacks and increase utilization of whey and soy protein ingredients in a novel product concept.

What has been done

Twenty formulations were developed with a total protein content of 28, 33, 38 and 43% [w/w] comprised of ratios of whey to soy protein of 100:0, 75:25, 50:50, 25:75 and 0:100 [4 × 5 factorial design]. Formulations above 33% total protein were developed to meet the Food and Drug Administration's requirements for a high-protein food claim, for which there is little research done in this type of application. Instrumental analyses were used to characterize the physical properties of samples. Descriptive analysis was conducted on the samples with 12 trained panelists in order to quantitatively profile the sensory characteristics. Findings showed that both protein level and protein type had a significant effect on models predicting attributes generated during descriptive analysis, rated on a 16-point scale. In terms of appearance, increasing protein level resulted in lower predicted values for models predicting puffed, porous and uniformity attributes. Attributes for sample aroma were mainly affected by protein type. Increasing whey protein resulted in higher values in models predicting dog food and buttery aromas, meaning samples higher in soy protein were stronger in aroma attributes of roasted soy and toasted corn.

Results

For basic taste attributes, increasing protein level had minimal effect. Varying protein type significantly affected models predicting basic taste attributes, with increasing whey protein predominantly increasing the value for the model predicting sweetness. For aroma-by-mouth attributes, varying protein level and protein type had a significant effect on the models. Increasing protein level resulted in lower predicted values for toasted corn aroma-by-mouth, likely due to decreasing amounts of corn meal in the formulation. Protein type also had an effect, with increasing whey protein level resulting in increased values for models predicting cheese, dried creamer, and buttery aromas-by-mouth. For texture attributes, the degree of sample expansion had a significant impact on texture characteristics. Increasing protein level inhibited expansion, resulting in higher values for the model predicting crunchiness, defined as the amount of force required to chew during the 1st through 3rd chews, and lower values for the model predicting crispiness, defined as the amount of airiness felt during the 1st through 3rd chews.

Increasing whey protein content also inhibited expansion, similarly affecting crunchiness and crispiness models but to a higher degree. As protein level and percent whey increased, predicted values for the model for grittiness decreased. Instrumental testing showed that water hydration capacity decreased with soy protein addition, which may correlate to the particles not dissolving during chew down in these samples.

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
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components

703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population

Outcome #11

1. Outcome Measures

Delivering Adequate Nutrition To At-Risk Populations

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Delivering adequate nutrition to at-risk populations and facilitating access to functional foods have become a new priority for the food industry. Dispersion of lipid soluble bioactives such as lutein and vitamin D in aqueous food systems, however, continues to be a significant challenge for the industry. Although strategies exist to add these compounds into aqueous systems, it is not without problems. For example, incorporation of new ingredients often leads to food deterioration and rapid spoilage, changes in rheology, less than optimal sensory characteristics, modified preparation and consumption habits, and interactions with other food components, thereby reducing the intended beneficial effect.

What has been done

This study aims at leveraging the properties of legume protein nano-aggregates to disperse and stabilize fat soluble compounds such as lutein and vitamin D. Besides enhanced dispersion, legume protein nanoparticles could add functionality to these vitamins by protecting them from the environment and offering enhanced bioaccessibility and bioavailability. These functions could translate into more suitable applications for the food industry, where the nanoparticles are created from generally recognized safe materials.

Results

These results showed a significant change in knowledge. The authors were able to create stable legume protein nanoemulsions amenable to dispersing two chemically-different bioactives [such as vitamin D and lutein]. The legume protein nanoemulsions have enhanced functionality as soluble proteins that allow for emulsification of oil and non-polar molecules protecting them from

UVC light, freeze drying, and simulated in vitro digestion conditions.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population

Outcome #12

1. Outcome Measures

Improving The Safety Of Hispanic-Style Fresh Cheeses

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Most styles of cheese are not commonly associated with foodborne pathogens. The majority of the risk associated with cheeses in general is due to outbreaks of *Listeria monocytogenes* in Hispanic-style fresh cheeses such as queso fresco. Such non-cultured, unripened cheeses have high moisture content, low salt content, and near neutral pH, so proper refrigeration is required to maintain shelf life. However, *L. monocytogenes* can proliferate at refrigeration temperatures, leaving few hurdles for its inhibition.

What has been done

Listeriosis outbreaks from illicitly-produced queso fresco make headlines and emphasize the growing market for these products, but many manufacturers hesitate to capitalize on such demand due to liability concerns. Strategies are needed to help prevent *Listeria* outbreaks and

allow for safer expansion of the market for Hispanic-style fresh cheeses. Outbreaks continue to occur, despite pasteurization of raw ingredients, due to listerial contamination during manufacturing processes. What research is available on Listeria control measures in fresh cheeses has confirmed survival and growth of *L. monocytogenes* during manufacturing as well as during storage under refrigeration. Considering post-manufacture processes such as high-pressure or additional heat treatment can unacceptably alter the delicate cheese structure, there are no effective measures available to eliminate post-pasteurization contamination. This suggests direct incorporation of antimicrobial compounds into fresh cheeses may be necessary for Listeria control.

Results

Objective 1: Develop a Laboratory-Scale Method to Produce a Model Hispanic-Style Fresh Cheese. A laboratory-scale method that would enable the production of a Hispanic-style cheese in a biosafety cabinet is critical for the safe evaluation of potential antimicrobials. We have developed a model to do this and have submitted the results for publication. Our model cheese has similar composition as cheese made on a traditional scale [fat, protein, water].

Objective 2: In Vitro Screening of Antimicrobials [Bacteriocins, Organic Acids, Spice Extracts and Novel Ingredients] for Activity Against Listeria Monocytogenes. We have made significant progress with this objective. We have tested several commercially-available products for antilisterial activity and found that nisin and ferrulic acid had the most promise from our initial screening. We will continue screening for more effective antimicrobials.

Objective 3. Evaluation of Selected Antimicrobials in Our Hispanic-Style Fresh Cheese Model. Nisin [a bacteriocin produced by *Lactococcus lactis* and widely used by the food industry] was able to decrease the listerial population briefly but the population quickly recovered. Ferrulic acid [which is present in many plants] was bacteriostatic against *L. monocytogenes* in our model. Another key observation was that the activity of the various antimicrobials we tested were far different in our model cheese than they were in simple broth experiments [Objective 2]. This confirmed that it is critical to evaluate these antimicrobials in the cheese matrix.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
704	Nutrition and Hunger in the Population
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 #13

1. Outcome Measures

Managing Bacterial Wilt In Cucurbits

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Bacterial wilt disease of cucurbits, caused by *Erwinia tracheiphila*, is a serious bacterial disease resulting in crop losses of up to 80%. The pathogen is transmitted by cucumber beetles. An effective strategy of controlling the disease is to manage insect vectors. However, applying pesticides, which are toxic to bees during flowering and fruit, can lead to decreased pollination, low fruit qualities, and environmental and health concerns. Therefore, alternative management measures should be sought to solve these problems, especially for home gardening and organic production. On the other hand, little research has been done on the pathogen side. No genetic information of the pathogen is currently available. Therefore, there is a critical need to obtain the genetic information of the pathogen, which could lead to a better understanding of how the pathogen causes disease and how to best seek alternative control measures. Moreover, there is also a critical need for disseminating the knowledge about bacterial wilt disease to the general public, especially for home gardening and organic production.

What has been done

The draft genome sequences for two strains of *Erwinia tracheiphila* were obtained with both shotgun and pair-end libraries. A total of 620 million bases represent about 60 fold coverage of the genome at approximately 4.8 Mb. Initial assembly yielded about 42 scaffolds with about 400 contigs. An OpMap for both genomes based on restriction enzyme digestion was generated, and all the contigs and scaffolds were aligned to the map. In addition, the number of plasmids in the two strains of *E. tracheiphila* and the contigs that belong to the plasmids based on gene content were determined. Genome sequences of the two strains were also compared, and 37 and 40 gaps were closed, respectively. Several hundred primers were designed for gap closing.

Furthermore, bacterial populations within the insect vectors of *E. tracheiphila* were determined. Six major bacterial species belong to six different genera within Enterobacteriaceae, which

includes most of the currently known microbes that are of concern to food safety on fresh produce. The next step for this project is to determine the microbiota of insects and to submit the genome sequences to NCBI.

Results

We have generated high-quality draft genome sequences and genome maps for two Et strains, which may promote the identification of virulence factors as well as determinants of host specificity. This is the first report of genome sequences for Et strains. The outcomes of this project not only provide new and much-needed knowledge to the research community, but also benefit cucurbit growers in the U.S. Moreover, understanding the bacterial population within insect vectors will provide information for the potential source of microbial contamination for fresh produce, which is of great concern for fresh produce safety.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
216	Integrated Pest Management Systems
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 #14

1. Outcome Measures

Increased Knowledge Of Fresh Fruit And Vegetable Production Practices

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	192

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Fruit and vegetable producers are seeking ways to improve their efficiency of production leading to enhanced profitability of their enterprise. Ultimately, consumers benefit in accessing quality

produce that enhances their health and is safe for consumption. Increased demand for locally produced foods is well documented in Illinois. Despite increasing demand only 1.1% of all crop sales recorded in Illinois for 2007 were fruits and vegetables and the average age of those producers was 57.7 years. To meet the demands of consumers, their roles must be filled by new growers. High start-up costs and lack of sufficient knowledge of business planning, production details, and marketing are challenges that must be overcome in attracting new growers.

What has been done

A number of annual one-day Extension schools for commercial fruit and vegetable producers are held during the winter months throughout the state and in conjunction with neighboring states. These include vegetable, fruit, strawberry, and small fruit schools. Extension educators and specialists assist in organizing, promoting and teaching the latest research findings related to production, pest management, marketing, and safe food handling. This past year a formal evaluation was collected from participants at the end of the Southern Illinois Vegetable School and the two Southern Illinois Tree Fruit Schools.

In addition, as part of a three-year NIFA grant, Year 2 activities of the Preparing a New Generation of Illinois Fruit and Vegetable Farmers included classes with hands-on and in-field experiences in English at three locations in the state held on one Saturday per month. Seventy-seven participants [new farmers, aspiring farmers and educators] completed this program. In addition, 15 participants completed the Spanish-language programs also held at three site locations. Seven participants used incubator plots to gain hands-on farming skills, and 34 educators [Extension and others] attended one or more sessions during the year. The teaching curriculum [30 Power Point presentations and associated online references] were revised and made available as YouTube videos online for viewing prior to classes to allow for more in-depth discussions. An evaluation questionnaire was collected at the end of the year.

Results

The approximately 250 attendees at fruit and vegetable schools were offered an option to rate the knowledge they gained for each of the individual topic sessions using a 1-5 scale with 1=None/Already knew and 5=Learned a great deal. A total of 69 growers completed the evaluation. All but one of the 21 vegetable producers who responded checked at least one topic as a 4 or 5, while 12 checked a 5 rating for at least one session topic. All but two of the 48 fruit producers who responded checked at least one topic as a 4 or 5, while 27 checked a 5 rating for at least one session topic.

All those who completed the Preparing a New Generation of Illinois Fruit and Vegetable Farmers evaluation indicated experiencing a change in knowledge, abilities, skills, and /or farming. Eighty-six percent [86%] plan to start farming, 90% of those who plan to start or are currently farming plan to increase the scale of their farming operations, 5% decided not to start farming or to discontinue their initial efforts, and 59% changed their attitudes about how to operate a successful small farm business. All participants indicated the program met most or all of their expectations. In addition, 55% adopted plans or practices to increase their production efficiency, and similarly 43% plan to increase environmental sustainability. Additional results are posted in the Evaluation section of this planned program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

216	Integrated Pest Management Systems
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources

Outcome #15

1. Outcome Measures

Increased Knowledge Of Small Farm Production Options

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	73

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Owners of small acreages are in need of assistance in determining how they can best put them to use.

What has been done

Extension Educators with assigned responsibility for small farms and local foods education developed Putting Small Acres to Work, a one-day program that addressed a variety of topics that was offered to help people who have a few acres learn ways that they can put them to use. One hundred ninety [190] individuals attended one of three workshops held at various locations in the state. An end-of-workshop evaluation form was distributed and collected from 73 of the participants at three of the six workshops.

Results

Respondents to the Putting Small Acres to Work end-of-program evaluation were asked to identify the degree to which their knowledge, confidence and abilities were changed regarding putting their small acres to work. Using a scale from one to five [1=No change; 5=Greatly improved], the average score for 69 who responded was above a 3.5 for all the items. Responses to specific evaluation items were: [1] Ability to effectively find and access resources to support their small acreage systems [4.29 average group score; 58 of 68 [85.3%] choosing a rating of 4 or 5]; [2] Ability to develop goals for their property [3.99 average group score; 47 of 67 [70.1%] choosing a rating of 4 or 5]; and [3] Knowledge of concepts and principles of managing small acreage [3.90 average group score; 43 of 67 [64.2%] choosing a rating of 4 or 5].

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
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
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Food Service Safety

5-Hour Refresher Course

University of Illinois Extension Nutrition and Wellness Educators conducted three **Food Service Sanitation Management Certification** courses in 2013-2014. Fifty individuals involved in serving food to the public participated in the programs as a requirement to maintain their food service certification by the Illinois Department of Public Health. In order to identify changes in their knowledge of food safety, participants were asked multiple-choice questions at the beginning and at the end of the five-hour course. The questions were designed to address critical practices and recent regulation updates to reduce the risk of bacterial contamination that can cause foodborne illnesses. In addition, 102 food bank managers and staff members who were involved in distributing food to those in need participated in the program that was adjusted to address their unique food handling safety challenges and completed a multi-choice pre- and post-test set of questions that addressed the content of that training.

All but one of the participants demonstrated an increase in knowledge to prevent food contamination by correctly answering at least one question correctly at the end of the course that they had incorrectly answered before the course began. Twenty-five [50%] were able to correctly answer 3 to 6 additional questions correctly at the end of the training. In

addition, more than half of the participants who had answered each question incorrectly before the program answered it correctly at the end for the following items:

36 [72%] learned the temperature range [danger zone] when food is most susceptible to the growth of bacteria that can cause food borne illnesses.

35 [70%] learned that ready-to-eat potentially hazardous foods can be stored in the refrigerator for no more than seven days.

29 [58%] gained knowledge about how to correctly label prepared foods that are stored in the refrigerator or coolers.

With respect to food bank staff responses to nineteen pre-post-test questions, 70 increased their knowledge of temperatures for serving and storing foods.

28 [28%] gained knowledge about the temperature zone [41 degrees Fahrenheit to 135 degrees Fahrenheit] when food is most susceptible to the growth of bacteria that cause food borne illnesses.

20 [20%] learned that when evaluating perishable food for safety, the most important characteristic is temperature.

19 [19%] learned that food and food contact equipment should be stored at least six inches off the floor and away from the walls.

18 [18%] learned that leaving potentially hazardous food in the temperature danger zone for more than two hours can grow disease-causing microorganisms that can make someone sick.

Serve it Safely

The University of Illinois Extension **Serve It Safely** program is designed for volunteer groups that sell food to the public, often as a fundraising effort. In order to determine the impact of the program, participants were sent a follow-up evaluation to complete three months after the program ended. Participants were asked to provide information on the adoption of eight food safety practices. For each practice, participants could respond with 'Always have', 'Have been since the program', and 'Does not apply'. Also offered as responses were 'Plan to do' and 'Don't plan to do'.

Practice Changes Adopted

Two-thirds of the 26 participants from thirteen counties who responded indicated that they had changed their food handling procedures. Eighteen of 26 participants [69%] adopted one or more of the practices to safely serve food at events. Practices changed by nearly a third of the evaluation respondents included washing their hands for at least 20 seconds using soap and warm water and using a thermometer to check temperatures of foods. Other practices adopted included using a separate hand-washing sink, using slow cookers only to hold hot foods hot and not to reheat foods, labeling items clearly when storing prepared food, preparing all foods on site [rather than at home], making their own sanitizing

solution, and eliminating use of home canned food in their operation. In response to two other questions, 88% indicated feeling more confident in preparing foods to serve to the public, and all but one reported being more aware of basic food safety principles, which when followed, can help reduce the risk of food borne illness.

Cottage Food Law Food Safety

University of Illinois Extension Nutrition and Wellness Educators conducted two-hour workshops to address the **Illinois Cottage Food Operation Law** regarding low-risk foods prepared at home and sold at Illinois farmers' markets. In order to identify changes in knowledge of food safety, the participants were asked to answer five multiple-choice questions at the beginning and at the end of the two-hour course. The questions were designed to address critical practices and recent regulation updates to reduce the risk of bacterial contamination in food products sold at farmers markets that can cause foodborne illnesses. A total of 79 completed the questions both before and after the workshops.

Seventy of the 79 [89%] who responded to the questions demonstrated an increase in knowledge to prevent food contamination by answering one of the questions correctly at the end of the workshop that they had incorrectly answered before the workshop began.

46 [58%] participants learned what foods are permitted to be made for sale by a Cottage Food Operation.

38 [48%] were able to correctly identify what safety practices were and were not required by the law.

26 [33%] were able to indicate what information must be on the food package to conform to the labeling requirements of the law.

12 [15%] learned the legal definition of a Cottage Food Operation.

11 [14%] were able to correctly identify a 'potentially hazardous food' after the program.

Good Agricultural Practices [GAPs] Training Evaluation

An end-of-meeting evaluation form consisting of seven questions was distributed and collected from 130 of the participants in six one-day and two online multi-session **Enhancing Specialty Food Safety** programs. An evaluation was also mailed in September of 2014 to all attendees in the eight programs who provided an address [119] to identify any of 34 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 16 of 26 attendees [specialty crop producers and other individuals interested in food safety practices]. It should be noted that the low response rate is likely due to mailing the evaluation during the busy growing season in order to meet a grant funding deadline.

Knowledge Changes

A key question asked respondents to assess the knowledge level gained on specific topics that were covered in the conference using a scale from one to five [1=None/already knew; 5=A great deal]. The average score for the 130 respondents was a high three or above for all topics. The areas of greatest learning were:

Preparing for a GAPs audit [4.58 average group score; 92 of 129 [71%] checked 'A great deal'].

Keeping records [4.30 average group score; 73 of 130 [56%] checked 'A great deal'].

Minimizing risks during postharvest handling [4.10 average score; 56 of 130 [43%] rated this 'A great deal'].

Manure handling and application [4.09 average score; 60 of 127 [47%] checked 'A great deal'].

Minimizing risks during food production [4.08 average score; 55 of 128 [43%] rated this 'A great deal'].

Practice Changes Implemented

Five questions encompassed 34 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] Recordkeeping. Respondents were presented with five options for each practice that included 'Did prior', 'Done as a result', 'Plan to do', 'Don't 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 testing well and surface water, recording application of surface water, and purchasing compost. Nearly one-half of the respondents did not have employees and had no need to implement changes related to worker health and hygiene.

However, 16 of the 26 respondents [62%] identified practice changes that they had implemented.

Eight [31%] of the respondents indicated implementing practice changes related to water usage and water quality.

Eight [31%] of the respondents indicated implementing practice changes related to facilities and equipment sanitation.

Seven [27%] of the respondents indicated implementing practice changes related to worker health and hygiene.

Five [19%] of the respondents reported making changes in manure handling and field application.

Six [23%] of the respondents indicated implementing practice changes related to record keeping.

Specific practices most frequently marked as changes by **five or more** respondents included: Prior to harvest, clean and sanitize all storage facilities [7 respondents]; Clean and sanitize trucks and other transportation vehicles before loading [7]; Monitor the level of chlorine in sanitizing solutions [7]; Monitor chlorine and other disinfectants in water used to wash produce [6]; Monitor produce wash water temperature to ensure it is not less than 10 degrees Fahrenheit cooler than produce [5]; Monitor the cooling bath temperature to ensure it is not less than 10 degrees Fahrenheit cooler than produce [5]; Cover clean storage bins when not in use [5]; Clean harvesting bins/aids daily [5]; Remove field soil from the outside of harvesting container/bins prior to moving them into packing areas [5]; Wash, rinse, and sanitize the packing area, equipment, and floor at the end of each day [5]; and Evaluate fertilizer sources for GAPs safety [5].

An additional nineteen [19] practices have been implemented by at least one respondent. In addition, 21 of 26 [81%] indicated that they planned to implement at least one additional practice change. All but two of 34 practices were checked as 'Plan to do' by at least one and as many as nine respondents.

Fresh Fruit and Vegetable Production Evaluation

The attendees [267] at the two **Southern Illinois Commercial Tree Fruit schools** and the **Southern Illinois Commercial Vegetable school** once again were offered an opportunity to rate the knowledge they gained for each of the individual topic sessions using a 1-5 scale with 1=None/Already knew and 5= Learned a great deal. Sixty-nine responded.

Fruit and Vegetable Program Knowledge Gained

All but two of the 48 who responded checked at least one topic as a 4 or 5, while 27 checked a 5 rating for at least one session topic at the Southern Illinois Fruit School. All topics were rated 4 or 5 by 50% or more of those who responded. The list of topics that follows are those that were rated 4 or 5 in order of the percentage of those who circled that rating regarding knowledge gained. Management of Blossom Blight and Brown Rot in Peaches--rated 4 or 5 by 37 of 45 individuals who responded [82%].

Disease Management in Peaches, Scab and Bacterial Spot--rated 4 or 5 by 37 of 47 individuals [79%].

Peach Insect Disease--rated 4 or 5 by 30 of 45 individuals [67%].

All but one of the 21 commercial vegetable growers who completed the evaluation checked at least one topic as a 4 or 5, while 12 [57%] checked a 5 rating for at least one session topic. All topics were rated 4 or 5 by more than half of those who responded. The list of topics rated the highest by percentage are as follows:

Vegetable Insect Update--rated 4 or 5 by all 11 individuals who responded [100%].

Disease Management in Cucurbit Production--rated 4 or 5 by 11 of 13 individuals who responded [85%].

Blossom End Rot: A Major Physiological Disorder of Tomato--rated 4 or 5 by 17 of 21 individuals who responded [81%].

Utilizing Cover Crops in Vegetable Production systems--rated 4 or 5 by 12 of 17 individuals who responded [71%].

Practices Implemented by Individuals Who Attended the 2014 Southern Illinois Fruit Schools and 2014 Southern Illinois Vegetable School

Attendees at the **2014 Southern Illinois Fruit Schools** were asked to indicate practices that they implemented as a result of what they learned at last year's schools. Eighteen individuals responded to this question, representing 37% of those who completed the evaluation. Twelve of the 18 [67%] controlled a fruit pest using herbicide/fungicide recommendations shared by a presenter; 11 [61%] improved their record keeping; 10 [56%] planted a new variety of peaches or apples; 9 [50%] implemented fertilizer adjustment; 8 [44%] investigated or planted new rootstock or cultivars; 7 [39%] ordered trees earlier; and 2 [11%] developed a GAP plan.

Attendees at the 2014 **Southern Illinois Vegetable School** were asked to indicate which of six practices they have implemented as a result of what they learned at last year's school. Only five individuals responded to the question with four [80%] indicated that they grew new varieties; three [60%] improved field monitoring/scouting insects and disease; two [40%] improved or increased soil sampling and testing, two [40%] diversified items taken to market; and one [20%] controlled a vegetable pest using herbicide/fungicide recommendations shared by a presenter.

Preparing a New Generation of Illinois Fruit and Vegetable Farmers

Participants [126] in this three-year program completed a questionnaire following the final class of this year's program. These participants included 77 English-speaking new or aspiring farmers and educators and 15 Spanish-speaking Hispanic participants.

Participant responses to questionnaires indicated that as a result of this program: [1] 100% experienced a change in knowledge, abilities, skills, and/or farming intentions; [2] 86% plan to start farming or are currently farming and plan to continue; [3] 90% of those currently farming plan to increase the scale of their farming operations; [4] 5% decided not to start farming or to discontinue their initial efforts; [5] 59% changed their attitudes about how to operate a successful small farm business; [6] 55% adopted plans or practices to increase their production efficiency; [7] 43% adopted plans or practices to increase their environmental sustainability; and [8] 82% plan to increase their participation in future educational programs for fruit and vegetable producers.

Participants were asked 'To what extent did this program meet your expectations?' All indicated that their expectations were met to some degree [Exceeded = 43%; Completely = 32%; Mostly = 25%].

Participants were asked 'How much did this program help you in developing your farming plans?' All indicated that they were helped somewhat or to a greater degree [A great deal = 68%; Just what I needed = 9%; Somewhat = 23%].

Participants were asked to indicate which of the following documents they had completed at the end of the course. The following percentages had developed a: Business plan = 57%; Production plan =47%; Marketing plan = 36%; or Financial plan = 43%.

Participants were asked to indicate if at the end of the course they knew how to access various resources. More than 80% had accessed: USDA programs and services [such as NRCS or FSA] = 95%; markets = 90%; business management support [such as SBDC] = 86%; production information [seed catalogs, newsletters, or production guides] = 97%; grower networks = 81%; and credit =86%.

Putting Small Acres to Work

An end-of-program evaluation was distributed to the 190 **Putting Small Acres to Work** participants and collected from 73 participants. Respondents to the **Putting Small Acres to Work** evaluation were asked to identify the degree to which their knowledge, confidence and abilities were changed regarding putting their small acres to work. Using a scale from one to five [1=No change; 5=Greatly improved], the average score for 73 respondents was above a 3.5 for all the items.

Ability to effectively find and access resources to support their small acreage systems [4.29 average group score; 58 of 68 [85.3%] choosing a rating of 4 or 5].

Ability to develop goals for their property [3.99 average group score; 47 of 67 [70.1%] choosing a rating of 4 or 5].

Knowledge of concepts and principles of managing small acreage [3.90 average group score; 43 of 67 [64.2%] choosing a rating of 4 or 5].

Confidence in using small acreage management principles [3.76 average group score; 39 of 68 [57.4%] choosing a rating of 4 or 5].

Knowledge about land stewardship and resource management [3.72 average group score; 44 of 68 [64.7%] choosing a rating of 4 or 5].

Understanding about farming practices [3.66 average group score; 38 of 67 [56.7%] choosing a 4 or 5 rating].

Preparedness to start a farming enterprise [3.55 average group score; 33 of 65 [50.8%] choosing a rating of 4 or 5].

When asked if their personal objectives for attending this workshop were met, 64 respondents provided a rating using a five part scale [1=Not met, 3=Satisfactorily met and 5=Extremely met]. All except one of them [98.4%] chose a rating of 3 [Satisfactorily met] or above. Twenty-eight [43.8%] marked a rating of 5; 23 [35.9%] marked a rating of 4, and 11 [17.2%] marked a rating of 3.

When asked to list the most important ideas they plan to put into practice as a result of participating in the workshop, 74 [44.5%] responded. Twenty-nine [39%] of the 74 participants listed specific planned actions. Most often mentioned [14 responses] were planning actions including developing/writing a business or marketing plan and setting goals.

Key Items of Evaluation

Food Service Safety

The responses to questions before and after the **5-hour Refresher Course** food safety programs for individuals involved in retaining certification to serve food to the public indicated that 96% of the 28 participants gained knowledge in handling food safely. Most notably, 21 [75%] of the participants learned that ready-to-eat potentially hazardous foods can be stored in the refrigerator for no more than seven days. In addition, two-thirds of them learned the temperature range [danger zone] during which food is most susceptible to the growth of bacteria that cause foodborne illnesses and how to correctly label prepared foods that are stored in the refrigerator or in coolers. In addition, 22 food bank staff members [29%] gained knowledge regarding the temperature zone when food is most susceptible to the growth of bacteria that can cause foodborne illness and that appearance is the most important characteristic in evaluating perishable food.

Using the information collected in 2011 through a University of Illinois Extension random survey that indicated that the conservative number of meals participants reported serving daily was 100 and the annual number of food handlers trained this year, an estimated 2,700 additional meals per day are free of contaminants that can cause foodborne illnesses. Based on the March, 2010 study funded by the Pew Charitable Trust indicating that the average cost each time someone gets sick from food is \$1,850, this shared knowledge clearly represents a substantial reduction in healthcare costs.

Nineteen [73%] of the 26 **Serve It Safely** participants who returned the follow-up evaluation adopted one or more of the practices to safely serve food at events. Twenty-three [89%] indicated feeling more confident in preparing foods to serve to the public, and all but one reported being more aware of basic food safety principles which, when followed, can help reduce the risk of food borne illness.

Nearly 90% of the **From Garden Gates to Dinner Plates** participants who provided information before and after the program demonstrated an increase in knowledge regarding the requirements of the Cottage Food Law and the foods that are permitted to be sold at farmer's markets.

Good Agricultural Practices [GAPs] Training Evaluation

More than 70% of the end-of-program evaluation responses indicated that they had learned a great deal about enhancing specialty food safety pertaining to preparing for an audit of implementation of safety practices and approximately one-half indicated learning a great deal about keeping appropriate records related to these practices. A follow-up evaluation evidenced food safety practice changes had been implemented by nearly two-thirds of the respondents, primarily with respect to water usage and facilities and equipment sanitation

[such as cleaning procedures for trucks, storage, and harvesting bins]. Approximately one-third of the respondents created a written food safety plan for their food production enterprise that will reduce their risk of food contamination by microorganisms that cause foodborne illnesses. However, only two conducted a self-audit of their enterprise.

These actions will position the program participants to be in compliance with rules and policies that regulate production and handling practices of 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.

Fresh Fruit and Vegetable Production Evaluation

Responses collected through the evaluation forms evidenced a high level of knowledge gained regarding all of the topics for the 2014 **Southern Illinois Commercial Tree Fruit School** and the **Southern Illinois Commercial Vegetable School**. All topics offered at the **Southern Illinois Fruit School** received a 4 or 5 rating from 50% to 82% of those who completed the evaluation. Likewise, approximately 40% of those completing the evaluation listed something they planned to do with information on implementing suggested practices and 18 indicated implementing specific practices that had been recommended at the 2013 conference. With one exception, 2014 **Southern Illinois Vegetable School** participants who completed an evaluation indicated that they learned new information about one or more topics covered by the presenters. Ten individuals shared plans for using the information and five indicated implementing specific practices that had been recommended at the 2013 conference.

Responses collected from participants in **Preparing a New Generation of Illinois Fruit and Vegetable Farmers** through a questionnaire evidenced that all experienced a change in knowledge, abilities, skills, and/or framing intentions. More than half adopted plans [business, production, marketing, or financial] or practices to increase their production efficiency. In addition, more than 80% knew how to access USDA programs and services, markets, business management support, production information, grower networks and credit.

Small Acres Evaluation

Primarily motivated by the desire to seek information about options for using small acreage, 73 [all but one] of the **Putting Small Acres to Work** workshop attendees who completed the evaluation felt that their objectives were met. Most notably, their responses to the end-of-workshop evaluation indicated an increase in their ability to effectively find and access resources to support their small acreage system and to develop goals for their property, as well as knowledge of concepts and principles of managing small acreage. Sixty-eight [42%] listed actions they planned to take with 14 referencing intentions to develop business and marketing plans and setting goals. Ten of the participants indicated plans to do more research, find a mentor, and make use of resources identified through the workshop.