V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Access to Safe & Nutritious Food

☑ 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
501	New and Improved Food Processing Technologies	0%		10%	
502	New and Improved Food Products	5%		12%	
503	Quality Maintenance in Storing and Marketing Food Products	5%		1%	
504	Home and Commercial Food Service	5%		6%	
512	Quality Maintenance in Storing and Marketing Non-Food Products	0%		1%	
701	Nutrient Composition of Food	0%		3%	
702	Requirements and Function of Nutrients and Other Food Components	5%		6%	
703	Nutrition Education and Behavior	40%		8%	
704	Nutrition and Hunger in the Population	20%		3%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	0%		11%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	5%		31%	
721	Insects and Other Pests Affecting Humans	0%		5%	
724	Healthy Lifestyle	10%		3%	
806	Youth Development	5%		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	51.1	0.0	82.0	0.0

Actual Paid	71.1	0.0	63.9	0.0
Actual Volunteer	7.1	0.0	3.5	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**
919502	0	337845	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
935439	0	5726592	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
6776366	0	1076412	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

According to Centers for Disease Control and Prevention (BRFSS), in 2013, 69.9% of adults (age 18 and over) in the state of Arkansas were classified as either overweight or obese. In 2013, Arkansas was the only state in the US to show an increase in obesity rates, which now makes Arkansas the third most obese state in the United States.
Five of the ten leading causes of death in the U.S. have been linked to diet and lifestyle as contributing factors. Poor diet and obesity remain common problems especially among under-served populations. The Extension Food and Nutrition programs focus on: adoption and maintenance of healthy lifestyles for chronic disease prevention including regular physical activity and healthy eating. The food and nutrition program identifies and promotes evidence-based policies and practices that will reduce the incidence of chronic disease.
The nutrition education program responds to the nutritional issues and needs of Arkansans across the lifespan and socioeconomic spectrum. Participants gain knowledge and skills that will help them adopt appropriate behaviors to prevent or delay lifestyle-related chronic diseases.
Adult Arkansans with diabetes participate in the Extension's diabetes education program; those wanting to improve weight and other health outcomes participate in Extension healthy weight programs; those wanting to learn healthy food preparation techniques to prevent or manage chronic diseases participate in cooking schools that will help them choose and prepare foods rich in health-promoting phytonutrients and low in fat, saturated fat added sugars and sodium. In addition, professors at the University of Arkansas are conducting research in the areas of obesity and diabetes prevention in order to help reduce the incidence of these disease within the state and nationally.
Division of Agriculture faculty develop, evaluate, and disseminate education programs and curricula, incorporating new research and emphasizing healthy lifestyles to prevent and/or reduce childhood obesity. Programs Include but are not limited to:

- Supplemental Nutrition Assistance Program Education (SNAP- Ed) Adults and Youth
- Expanded Food and Nutrition Education Program (EFNEP) Adults and Youth
- Reshape Yourself Healthy Weight Program
- Walk Across Arkansas Youth

- BodyWalk
- Adventures in Grandparenting

Division of Agriculture faculty conduct novel research to determine the impact of diet and food composition and functional food components on body weight.

The Division of Agriculture faculty and staff develop, evaluate and disseminate education and curricula incorporating research and teaching. Programs include:

- Quarterly HACCP Roundtable meeting
- HACCP workshops
- Food safety and preservation workshops
- Better Process Control School
- ServSafe workshops
- Culinary arts training for food industry personnel
- Online distance education in food safety and manufacturing
- Assistance to small food companies and entrepreneurs in the form of services, workshops, and consulting.

Research activities in food safety include work to better understand the ecology of food pathogens, improve food processing systems to minimize food pathogens and to improve detection systems for Listeria, Salmonella, EColi and other major food pathogens.
Research activities in food chemistry and food processing include work to (1) improve the quality of rice and improve rice processes, (2) expand the utilization of soybeans and its co-products, (3) assess the health benefits associated with processed specialty crops and (4) improve the sensory quality of processed foods.

2. Brief description of the target audience

Youth

School personnel

Parents

Adults

Grandparents

Child Care Providers

Researchers
Food Manufacturers

Farmers (Farmer's Markets)
Entrepreneurs and Restaurants

Food Service Employees and/or Food Handlers

Employers & Employees

Health Professionals

Consumers

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	117460	526682	197293	6388

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

Patent Applications Submitted

Year: 2014

Actual: 2

Patents listed

Use of Lactic Acid Bacteria to Reduce Pathogens and as a Bio-Sanitizer. Inventors: Crandall, Philip / Ricke, Steven / Ware, DouglasUS Patent #14/236,542.

Use of Beta Resorcylic Acid and OtherGRAS Compounds for Control of Foodborne Pathogens in Poultry Products. US 62/024,234. Inventors: Ann Donoghue, Dan Donoghue & Kumar Venkitanarayanan

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	2	53	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- # of 4-H/Youth Food, Nutrition and Physical activity programs delivered related to eating healthy and being active

Year	Actual
2014	31363

Output #2

Output Measure

- # of youth contacts in 4-H/ Youth Food, Nutrition, and Physical Activity programs related to eating healthy and being active

Year	Actual
2014	184907

Output #3

Output Measure

- # of adult clientele contacts from educational events (educational classes, workshops, group discussions, one-on-one interventions, demonstrations and other educational activities) related to eating healthy and being active

Year	Actual
2014	58488

Output #4

Output Measure

- Number of Online Master of Agriculture (Food Safety Emphasis) students enrolled in courses

Year	Actual
2014	30

Output #5

Output Measure

- Number of projects focused on increased understanding of the ecology of fecal indicators and pathogens

Year	Actual
2014	2

Output #6

Output Measure

- Number of projects focused on increased understanding of preharvest and postharvest processes impacts on microbial and chemical threats

Year	Actual
2014	5

Output #7

Output Measure

- Number of projects focused on novel food processing technologies

Year	Actual
2014	4

Output #8

Output Measure

- Number of projects focused on improving the quality of food

Year	Actual
2014	10

Output #9

Output Measure

- Number of projects focused on the impact of food on nutrition and health

Year	Actual
2014	7

Output #10

Output Measure

- Total competitive federal Grant $ for program area

Year	Actual
2014	2774597

Output #11

Output Measure

- Total other competitive grant $ for program area

Year	Actual
2014	30750

Output #12

Output Measure

- Number of participants in educational programs leading to graduation from the Better Process Control School

Year	Actual
2014	97

Output #13

Output Measure

- Number of participants in educational programs leading to ServSafe certification for food handlers

Year	Actual
2014	471

Output #14

Output Measure

- Number of participants in quarterly HACCP roundtables
  Not reporting on this Output for this Annual Report

Output #15

Output Measure

- Number of culinary workshops for food technologists

Year	Actual
2014	4

Output #16

Output Measure

- Number of participants in culinary workshops for food technologists leading to certification as Certified Culinary Scientist

Year	Actual
2014	34

Output #17

Output Measure

- Number of culinary workshop participants completing 120 hours of required contact time for the Certified Culinary Scientist recognition

Year	Actual
2014	11

Output #18

Output Measure

- Number of food processing laboratory services provided

Year	Actual
2014	39

Output #19

Output Measure

- Number of nutritional labels developed

Year	Actual
2014	105

Output #20

Output Measure

- Number of food processing approvals developed (2541a)

Year	Actual
2014	12

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of participants receiving certification in Better Process Control
2	Number of participants receiving certification in ServSafe
3	Number of participants in other workshops related to Food Safety including HACCP, food safety, food defense, food labeling, and food microbiology workshops receiving attendance certification
4	Number of growers and producers receiving GAP certification or equivalent
5	Number of youth demonstrating improved knowledge of food safety or hand washing
6	Number of Online Master of Agriculture (Food Safety Emphasis) graduates employed in the food industry
7	Number of viable technologies developed or modified for the detection and characterization of foodborne pathogens
8	Number of viable prevention, control and intervention strategies for food borne threats in the food system
9	Culinary workshop participants passing the examination to become a Certified Culinary Scientist
10	Number of viable technologies developed or modified for improving food processing systems
11	Number of viable technologies developed or modified to improve the nutritive quality of foods
12	Number of small businesses started as a result of the food entrepreneur assistance program
13	Number of children who practice healthy eating
14	Number of children who engage in healthy levels of physical activity
15	Number of families, children, and youth who have access to healthy foods
16	Number of adult participants who reported they less often run out of food before the end of the month following completion of a nutrition education program.
17	Number of participants who adopted one or more food/nutrition practice

18	Number of studies conducted related to factors affecting childhood obesity

Outcome #1

1. Outcome Measures

Number of participants receiving certification in Better Process Control

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	97

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

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

Outcome #2

1. Outcome Measures

Number of participants receiving certification in ServSafe

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	342

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Centers for Disease Control and Prevention estimates that each year approximately 48 million people gets sick, 128,000 are hospitalized and 3,000 die of foodborne diseases. Additional estimates provide the most accurate picture yet of which foodborne microbes cause the most illnesses in the United States. They include Salmonella, norovirus, Clostridium perfingens, and Campylobacter. Specific to Arkansas, the state has over double the desired CDC target rate for salmonellosis per 100,000 individuals.

What has been done
The University of Arkansas Division Of Agriculture Cooperative Extension Service offers a comprehensive approach to address food safety from industry to the individual. Taught in many Arkansas counties the ServSafe® Food Safety Program for Managers course provide the necessary tools for industry managers to effectively teach food service employees best practices in food safety.

Results
Over 470 individuals were trained using the ServSafe® Managers curriculum by the University of Arkansas Division of Agriculture Cooperative Extension Service. Of those participants 73% or 342 of 471 received certification which means they received a 75% or higher on a comprehensive exam covering principles of the FDA Food Code developed by the National Restaurant Association.

4. Associated Knowledge Areas

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

Outcome #3

1. Outcome Measures

Number of participants in other workshops related to Food Safety including HACCP, food safety, food defense, food labeling, and food microbiology workshops receiving attendance certification

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	36

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

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

Outcome #4

1. Outcome Measures

Number of growers and producers receiving GAP certification or equivalent

2. Associated Institution Types

- 1862 Extension

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)
Over the past few decades, there has been an increase in the concern of foodborne illness resulting from the consumption of fresh produce. On average 37% of foodborne illnesses result from the consumption of produce such as melons, tomatoes, greens, and berries that do not receive a heat treatment prior to consumption. In January 2013, the FDA published proposed regulations on Good Agriculture Practices as part of the Food Safety Modernization Act that require certain field operations that would prevent the fecal contamination of fresh produce. The comment period was originally scheduled to end May 15 but has been delayed several times (Sept 15 and Nov 15). This past year, the FDA opened a Supplemental Rule for amending the regulations with final regulations expected to be published in August 2015.

What has been done
The Institute of Food Science & Engineering at the University of Arkansas has previously developed a voluntary GAP program for small scale growers such as those who sell at farmers markets and to schools in the ?Farm to School? program. This program is currently being used throughout Arkansas mainly for the ?Farm to School Program. We plan to continue to conduct training sessions in 2015 mainly for small scale growers that sell to farmers markets. Also in 2015, we plan to conduct a train-the-trainer workshop for county agents with the Produce Safety Alliance (PSA) in Fort Smith to facilitate the FDA requirements for large scale produce growers.

Results
Many small scale produce growers have been requesting assistance in developing a voluntary GAP program in order to be able to sell at farmers markets and to schools. This should improve the food safety of produce being sold at farmers markets and to school systems. Many large scale growers are anxious to be FDA GAP compliant however we cannot conduct training until the PSA has completed the initial tests on the curriculum and assisted the eight top produce growing states.

4. Associated Knowledge Areas

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

Outcome #5

1. Outcome Measures

Number of youth demonstrating improved knowledge of food safety or hand washing

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	5818

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Consumer food safety is a concern for everyone especially among at risk populations. At risk populations include the immunocompromised, preschool aged children and older adults. One of the best ways to prevent foodborne illness is by the simple act of hand-washing yet a large body of literature suggests that a minority of the population washes their hands after using the restroom as an example.

What has been done
The University of Arkansas Division Of Agriculture Cooperative Extension Service offers food safety education coupled to nutrition and health education. Youth nutrition and health education programming includes SNAP-Ed, EFNEP and 4-H Positive Development priority programs focused on healthy living and food security.

Results
Of the 8,585 youth reached by the University of Arkansas Division Of Agriculture Cooperative Extension Service's youth nutrition and health programs a majority gained knowledge or adopted safe food practices. Specifically, 75% or 3093 of 4271 of surveyed SNAP-Ed youth reported or demonstrated they more often practice personal hygiene such as hand washing as a result of participating in a SNAP-Ed program; 73% or 1778 of 2405 of surveyed 4-H participants reported or demonstrated they more often practice personal hygiene such as hand washing; and, 50% or 950 of 1909 EFNEP children and youth used safe food handling practices more often or gain knowledge.

4. Associated Knowledge Areas

KA Code	Knowledge Area

712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #6

1. **Outcome Measures**

   Number of Online Master of Agriculture (Food Safety Emphasis) graduates employed in the food industry

2. **Associated Institution Types**

   - 1862 Extension
   - 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	4

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

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

Outcome #7

1. **Outcome Measures**

   Number of viable technologies developed or modified for the detection and characterization of foodborne pathogens

2. **Associated Institution Types**

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Salmonellosis is one of the most common foodborne diseases in the United States. Given that Salmonella can originate from a wide variety of food production environments, reduction of this organism at all stages of food production is critical. This project has three components designed to address this problem. Our specific research program goal reflects an integrated approach for controlling Salmonella spp. and other foodborne pathogens at all stages of food production. The relative incidence of Salmonella spp. foodborne disease continues, despite the growing body of information regarding the most common contamination routes. During its life cycle Salmonella can encounter various environmental stress conditions which may have dramatic effect(s) on its survival and virulence. Although there is considerable information regarding environmental signals that control growth and pathogenesis in animals and humans, little is known about the biology of Salmonella during food processing. Research is needed to determine the environmental factors that are critical for survival of this pathogen and therefore must be modified to prevent the early establishment of Salmonella in food processing environments and virulence expression under these conditions.

What has been done
Our current food production Salmonella spp. research projects have emphasized studies on the growth, survival and pathogenesis of the organism under conditions encountered during poultry processing. However, the success of Salmonella spp. in becoming re-established in the gastrointestinal tract of food animals during certain phases of processing indicates that Salmonella spp. can competitively interact with the dynamics of the food matrix. Based on these observations, our plan is to continue to focus on salmonellae metabolism and genetic regulation of stress responses when grown under processing conditions and determine how these overlap with expression of virulence when foodborne Salmonella spp. become pathogenic. The outcome of this research has implications not only for persistence of foodborne salmonellae in processing, but raises practical issues regarding the choices of antimicrobials as intervention steps in processing. Issues we are now pursuing include whether thermal treatment predisposes salmonellae to be more resistant to particular antimicrobials and how these conditions might influence virulence and pathogenic characteristics of salmonellae. Molecular techniques will delineate some of the phenotypic responses we have observed thus far and examine virulence expression of Salmonella under typical food production and processing conditions.

Results

Illness from Salmonella contaminated poultry is a huge problem. Despite the best efforts of the conventional poultry industry, the levels of Salmonella contamination are increasing. It is estimated that in the U.S., Salmonella causes more than 1.3 million persons to become ill, 553 deaths and economic losses of $2.4 billion annually. A total of 5,000 foodborne illness outbreaks with a known etiology and vehicle occurred from 1990-2004. Raw chicken and chicken products were linked to 214 outbreaks of foodborne illness and of these, 195 were caused by Salmonella. One of the objectives of the Healthy People 2010 Initiative (2000) established a goal of no more than 6.8 cases of salmonellosis/100,000 persons, which is half of the baseline rate of 13.6/100,000. Unfortunately, outbreaks still occur and Salmonella-mediated foodborne illness continues to be a serious problem. There are many potential foodborne vehicles, but contaminated poultry meat has been implicated as a major contributor to salmonellosis both in the U.S. and globally.

4. Associated Knowledge Areas

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

Outcome #8

1. Outcome Measures

Number of viable prevention, control and intervention strategies for food borne threats in the food system

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Outbreaks from the consumption of fresh produce are a concern in the United States. The consumption of fresh produce has increased since the last 20 years because of the health trend of eating more fresh produce. Fresh produce is minimally heated or processed before consumption, which makes them a possible source of foodborne illness. The demand for preventing foodborne illness is on the increase not only from public health organizations point of

view but also from an economical perspective since food recalls cause a substantial loss of money. Washing the produce is the most common protocol for disinfection in the food industry. But, pathogens like E.coli 157:H7 and Salmonella are able to survive washes by internalizing and forming a biofilm on the plant tissues. Research to disintegrate biofilms on fresh produce is scarce while some methods such as washing with chorine and irradiation have been proven ineffective. Effective multiple-hurdle technologies are needed to disintegrate biofilms and pathogen intervention.

What has been done
Disks from Spinach leaves and cantaloupe rinds were inoculated with E. coli O157:H7/ Salmonella Typhimurium by soaking for 24 h at 25 °C in a 24-plate that contained the culture. Disks were then washed to remove non-adherent bacteria and sprayed electrostatically with organic acids. Lactic acid and Malic acids at varying concentrations of 1.0%/2.0%/3.0/4.0 were used alone and in combination. Log reductions were determined to evaluate the best treatment that reduced the attached bacteria. Crystal violet assay and confocal microscopy were used to quantify bacterial attachment on spinach and cantaloupe. Organic acids were electrostatic sprayed to demonstrate biofilm disruption, studied using the crystal violet assay.

Results
The significance of this research is the utilization of electrostatic spray system for delivery of inexpensive organic acids as antimicrobials. The malic and lactic acids used in this research have GRAS (generally recognized as safe) status. Electrostatic spray of natural antimicrobials diminished the bacterial number as well as disrupted the biofilms formed by major human food-borne pathogens on spinach and cantaloupe surfaces. The bacterial populations were reduced by 4.1 logs, while disruption of biofilm has significant impact in minimizing cross contaminations during packaging of spinach and cantaloupe. Furthermore, this multiple hurdle technology has demonstrated effective decontamination methods with high potential for adoption in the produce packaging industry. This will significantly promote acceptance of natural antimicrobials among consumers, while providing enhanced economic benefits to the food industry.

4. Associated Knowledge Areas

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

Outcome #9

1. Outcome Measures

Culinary workshop participants passing the examination to become a Certified Culinary Scientist

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
504	Home and Commercial Food Service

Outcome #10

1. Outcome Measures

Number of viable technologies developed or modified for improving food processing systems

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The attractive red color of strawberries is due to elevated levels of anthocyanin pigments, primarily pelargonidin derivatives. Unfortunately, color deterioration coincides with anthocyanin losses when strawberries are processed into preserves and jams, juices, and purees, and these detrimental changes persist during storage of strawberry products at ambient temperature. Color instability in strawberry products has also been attributed to enzymatic browning, Maillard browning, ascorbic acid catalyzed degradation, and polymerization reactions of anthocyanins with other phenolics, and most of these reactions are promoted by oxygen. Exclusion of oxygen throughout processing and storage of strawberry puree may be a viable technology to improve anthocyanin and color retention.

What has been done

Fresh strawberries were vacuum-deaerated and processed into puree in a glove box under nitrogen or carbon dioxide atmosphere. Control samples were processed in the same manner in the glove box under air. All samples were pasteurized in boiling water at 100oC for 10 min and then stored in the dark at 25oC. Three jars of puree from each treatment, control (air), carbon dioxide and nitrogen were analyzed one day after processing and after 2, 4, 6, and 8 weeks of storage for color, anthocyanin composition by HPLC and percent polymeric color. Purees prepared under carbon dioxide or nitrogen retained more anthocyanins (75% and 82%, respectively) following pasteurization than samples prepared under air (60% and 72%), respectively. The protective effect of oxygen exclusion on anthocyanin stability persisted throughout eight weeks of storage at 25oC with purees prepared under carbon dioxide or nitrogen each showing 23% retention, while purees prepared under air showed only 7% and 10% retention. Purees prepared under carbon dioxide or nitrogen also had greater color stability evident by lower L*, hue and percent polymeric color and greater chroma values than puree processed under air over storage.

Results

Processing strawberry puree under carbon dioxide or nitrogen atmosphere resulted in greater retention of anthocyanins compared to puree processed under air. Purees processed under carbon dioxide or nitrogen also retained more anthocyanins and had better color stability evident by lower L*, hue and percent polymeric color and greater chroma values than puree processed under air over eight weeks of storage at 25oC. Strict oxygen exclusion during berry processing appears to be a viable technology to improve anthocyanin and color stability, but additional technologies are needed to prevent anthocyanin losses that occur under anaerobic conditions during storage.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies

Outcome #11

1. Outcome Measures

Number of viable technologies developed or modified to improve the nutritive quality of foods

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Around 34.5% of adult Arkansans were recently reported as obese, which ranks Arkansas as the third most obese state in the US, behind Louisiana (34.7%) and Mississippi (34.6%). The US obesity epidemic has resulted in significant levels of obesity related diseases, such as cancer, heart disease and type-2 diabetes. Studies have shown that about three grams daily of dietary conjugated linoleic acid (CLA) confers great human health benefits in reducing the clinical indicators of these diseases, improving immune function and promoting weight loss in obese persons; yet it is difficult to obtain sufficient CLA in a typical healthy diet to realize these clinical benefits.

What has been done
In an attempt to translate our technology from the laboratory to industry, early in 2014 we adapted a steam distillation method, used in conventional oil processing, for CLA-rich oil production. In spring 2014 We met with Riceland Foods scientists and technologists when it was suggested that in order to be commercially feasible we needed to reduce production costs by: 1) using lower doses of cheaper reagents; 2) using different processing equipment that would be more commercially viable.

Results
The CLA-rich soy oil developed in our laboratory would allow consumers to obtain the clinically effective daily intake to combat obesity related diseases. A half ounce serving of 20% CLA oil would provide 3.1g CLA/day and typical 7 g serving of CLA-rich margarine will provide 0.6g CLA. Thus, 5 margarine servings will provide the required 3.2 g/CLA day with only 185 calories/day, which is well within the maximum recommended 700-980 fat calories/day. In contrast, an 8 ounce serving of beef or milk will only provide 0.27g and 0.06g of CLA, respectively.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components

Outcome #12

1. Outcome Measures

Number of small businesses started as a result of the food entrepreneur assistance program

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The vast majority of jobs in the United States and in Arkansas are created by small, privately held companies. It is therefore vital to create an environment and conditions to assist small businesses to develop and hire people. Assisting small food companies and entrepreneurs in technical and business issues of the food processing industry can improve the Arkansas job situation and provide additional tax revenue for Arkansas.

What has been done
The Institute of Food Science & Engineering (IFSE) and the Cooperative Extension Service in the Department of Food Science at the University of Arkansas in Fayetteville assists small food processing companies and entrepreneurs by providing technical assistance in several areas. The use of the Arkansas Food Innovation Center (AFIC) has provided the platform which to help entrepreneurs. This past year we have trained entrepreneurs in Good Manufacturing Practices (GMPs) as required by the Arkansas Department of Health teaching them about food processing regulations and labeling requirements. We also have conducted 2 round-table discussion forums between the Arkansas Department of Health and entrepreneurs.

Results

The AFIC currently has approximately twenty active entrepreneurs using the facility. With this growth of the AFIC by entrepreneurs, some entrepreneurs are beginning to outgrow the AFIC which are success stories in the making. We are also seeing additional opportunities to training entrepreneurs in areas that need attention such as writing business plans and marketing. We are currently developing programs to address these areas.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
504	Home and Commercial Food Service

Outcome #13

1. Outcome Measures

Number of children who practice healthy eating

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	15139

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Obesity is a major health problem that frequently begins in childhood and adolescence. Overweight or obese children are more likely to become overweight or obese adults. Thirty-three percent of youth in Ashley County are at overweight or obese, which may lead to diabetes, high blood pressure, heart disease and many other problems.

What has been done
The Ashley County Cooperative Extension Service partnered with the Hamburg and Crossett School Districts to teach youth in grades K-5 how to make healthy food choices and the importance of being physically active. Fifty-seven monthly assemblies were conducted with three schools reaching a total of four hundred forty-one youth. Each parent received a monthly newsletter as well as quarterly CHOP CHOP magazines. The key messages taught were eat more fruits and vegetables, whole grains, low-fat dairy, lean protein and to be physically active at

least 60 minutes each day.

Results
Four hundred sixty-four parent surveys showed:
81% of parents said their child talked about healthy food/snacks
74% of parents said their child asked for more or different fruits, vegetables, milk or yogurt
77% of parents said their child talked about being more active
59% of parents said they are more active as a result of what their child learned
61% of parents said they made changes in family's eating practices
35% of parents said they serve vegetables their family hasn't tried before
31% of parents said they serve fruits their family hasn't tried before
60% of parents said they serve their family more vegetables
61% of parents said serve their family more fruit.

What SNAP-Ed parents are saying:
"It has helped my child to be more open to trying new food. She loves how healthy they are for you and she gets excited to try something new. Thank You."
"It helped me by lowering my blood pressure and to stay healthy."
"I cannot get my son to try new things. Somehow Mrs. Phifer has!!! So THANK YOU."
"My child has been more willing to eat healthier foods and exercise more."

Quotes from SNAP-Ed youth:
"I plan to eat more fruits & vegetables, eat different colors."
"I plan to pick a better snack because I want to have a better life."
"I plan to eat healthier and be more active."

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
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
724	Healthy Lifestyle
806	Youth Development

Outcome #14

1. Outcome Measures

Number of children who engage in healthy levels of physical activity

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	5439

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle
806	Youth Development

Outcome #15

1. Outcome Measures

Number of families, children, and youth who have access to healthy foods

Not Reporting on this Outcome Measure

Outcome #16

1. Outcome Measures

Number of adult participants who reported they less often run out of food before the end of the month following completion of a nutrition education program.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	1037

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In 2014 with an estimated population of 2,966,369 Arkansas is ranked 2nd in the nation for household food insecurity at 21.2% or 627,528 at risk individuals. Arkansas is ranked 1st in the nation for households with very low food security at 8.1%. Not surprisingly Arkansas has high childhood food insecurity rates at 28.4%. That means that one-fifth of households and over one-quarter of Arkansas's children are not sure where their next meal is coming from. Associated with adverse health outcomes, including behavioral problems in children and obesity and type 2 diabetes in specific subpopulations of adults, food insecurity has the potential to negatively impact a wide range of individuals and activities.

What has been done
The University of Arkansas Division of Agriculture Cooperative Extension Service's Supplemental Nutrition Assistance Program - Education (SNAP-Ed) and Expanded Food and Nutrition Education Program (EFNEP) were delivered in every Arkansan county in FY2014. They provided Arkansas's most vulnerable families and youth with hands-on opportunities to address food security challenges. With goals to teach food resource management and address food security issues SNAP-Ed and EFNEP aimed to increase knowledge and influence behaviors such that food security is improved among participants.

Results
Over 2000 adults were surveyed by the University of Arkansas Division of Agriculture Cooperative Extension Service regarding their personal food security. Adults who received nutrition education from the federal grant programs, SNAP-Ed and EFNEP, that target low-income individuals, reported improved food security. For example 50% or 864 of 1716 EFNEP adult graduates reported they less often ran out of food before the end of the month after receiving education and

59% of SNAP-Ed participants that were surveyed or 173 individuals reported less often running out of food before the end of the month as a result of participating in a SNAP-Ed program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle

Outcome #17

1. Outcome Measures

Number of participants who adopted one or more food/nutrition practice

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	8108

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In Arkansas, 68% of adults are overweight or obese, 9.6% have diabetes, 40% have high blood cholesterol and 36% have high blood pressure. Research shows that even small changes in diet and small decreases in weight can lower the risks for diabetes, heart disease and hypertension.

What has been done
Multiple educational approaches were used to respond to issues related to chronic illness and obesity. Healthy weight classes were offered in 9 counties. Participants learned to plan healthy meals, balance calorie intake with calorie expenditure, read food labels, reduce portion sizes and decrease fat and sodium intake. Cooking classes offered in 20 counties helped people learn skills that enable them to plan and prepare healthier meals at home. Participants learned to cook using healthier techniques, eat more locally grown foods and save money by eating at home more often. Eight counties offered programs to help people with diabetes better manage their disease. General nutrition programs were offered in 36 counties. Programs focusing on healthy weight, diabetes self-management and choosing and preparing healthy foods resulted in 17,470 contacts through 1,642 direct education methods. Programs provided to adults through the Expanded Food and Nutrition Education Program and the SNAP-Ed program resulted in 56,430 direct

education contacts through 14,327 educational sessions.

Results
Of adult participants in general nutrition programs, SNAP-Ed programs and EFNEP programs who were asked:
87% reported improvements in one or more nutrition practice
63% reported increased fruit and/or vegetable intake
42% reported increased lowfat or fat-free dairy intake
37% reported increased whole grain intake
60% reported reduced sodium intake
53% reported reduced fat intake
Of participants in healthy weight programs who were asked:
87% reported decreasing weight
75% reported decreased blood glucose and blood pressure
33% reported lower blood cholesterol

Changes like these can reduce the risk for diet-related chronic diseases and save participants money. Programs that help Arkansas reduce weight and improve health can reduce health care costs. Health experts estimate that every $1 invested in proven community-based disease prevention programs could save Arkansas ~$5 in future health care costs.

What participants are saying:
"This program was a lifestyle change. It is something I can keep doing. I was able to get in a dress I wore at my daughter's wedding over 8 years ago. I lost a total of 20 lbs & 17.5 inches. I could not have done this without this program." ~ ReNew You Participant

"This Extension program saved my life! My A1c was way too high and even though I have cooked all my life, I had no idea how to cook for myself as a diabetic. These classes taught me how to cook for a diabetic and eventually lower my A1c. My doctor is very happy with me." ~Living Well with Diabetes Participant

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle

Outcome #18

1. Outcome Measures

Number of studies conducted related to factors affecting childhood obesity

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Childhood obesity is a major public health issue and is presently receiving great deal of attention due to its broader economic consequences and long term effects on children?s overall health, academic accomplishments, quality of life and productivity as they become adults. Arkansas schoolchildren are especially at risk for obesity. Arkansas is among the poorest and least healthy states. The childhood obesity rate has doubled over the last couple of decades and is now one of the highest in the country (Arkansas Center for Health Improvement, 2009).

What has been done
Professors Nayga and Thomsen's work in this area received an important infusion of resources in 2011 when it was awarded a large USDA-NIFA-AFRI grant. They are leading this project but it involves a diverse team of scholars representing expertise in early childhood education, child nutrition, child development, and the behavioral sciences. The project is unique in that all participants are from Arkansas-based institutions. Participants include the UA Division of Agriculture, UA Fayetteville, University of Arkansas for Medical Sciences (UAMS), and Arkansas Children's Hospital Research Institute. The project also involves important stakeholder groups including childcare providers, educators, policy makers, and farmers. Professors Nayga and Thomsen are examining the link between childhood obesity outcomes and features of the food and social environment. This work is being done to ensure that interventions are targeted to those children most at-risk for obesity. They are working closely with the UAMS Arkansas Center for Health Improvement (ACHI) to access a unique individual-level dataset on obesity outcomes. Access to these data allows research to be conducted at a level of detail and accuracy that is not possible with national-level datasets.

Results
Nayga and Thomsen's research is able to assess causal linkages using quasi-experimental analytical methods and data-intensive identification strategies. Findings, published in the American Journal of Agricultural Economics, Economics and Human Biology, and Applied Economic Perspective and Policy, are providing a better understanding of the effect of supermarket access, the proximity of fast foods around schools and residences, the impact of school food programs such as the Fresh Fruit and Vegetable Program (FFVP) and the role of peers on childhood obesity outcomes.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Recent food safety "outbreaks" have heightened concern among the public about the safety of, not only processed and restaurant food, but also fresh foods in the store or from local growers. This has led to increased government regulations such as the Food Modernization and Safety Act, which has created a confusing litany of potential on-farm rules, certification standards, and so fort. We have responded with improved certification and on the farm safety information for producers, but lack of capacity has hampered our efforts. This is further complicated by changes in farm worker populations, where many immigrant workers in the state have to be engaged in their first language. Increasing public priorities in local foods, community food systems, and farmer markets - and the resulting programmatic and economic factors associated with these movements will continue to create additional demand on our limited resources. We plan to continue our food service safety programs, and hope that public policy changes will help in this arena over time.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Food Safety:
28% (464 of 1685) of EFNEP adult graduates more often followed the recommended practices of not allowing meat and dairy foods to sit out for more than two hours. Furthermore 54% (913 of 1685) ALWAYS follow the recommended practice.
62% (1056 of 1711) of EFNEP adult graduates more often followed the recommended practices of not thawing foods at room temperature. Furthermore 14% (233 of 1711) ALWAYS follow the recommended practice.
77% (173 of 289) of surveyed SNAP-Ed adults reported adopting one or more food safety practice as a result of participating in a SNAP-Ed program.
75% (3093 of 4271) of surveyed SNAP-Ed youth reported or demonstrated they more often practice personal hygiene such as hand washing as a result of participating in a SNAP-Ed program.

73% (1778 of 2405) of surveyed 4-H participants reported or demonstrated they more often practice personal hygiene such as hand washing.
73% (342 of 471) ServSafe® Managers course participants received certification.
87% (343 of 394) food preservation workshop attendees indicated they intended to adopt at least one food preservation practice following an education, class seminar or workshop.
Food Security:
67% (1164 of 1731) of EFNEP adult graduates more often planned meals in advance.
57% (980 of 1729) of EFNEP adult graduates more often compared prices when shopping.
50% (864 of 1716) of EFNEP adult graduates less often ran out of food before the end of the month.
64% (1088 of 1708) of EFNEP adult graduates more often used a list for grocery shopping.
Of 1439 reports average EFNEP adult graduate cost savings per month was $20.40 per participant.
51% (128 of 252) of surveyed EFNEP 6th-8th grade youth improved in their responses to: Using measuring cups and spoons?
35% (87 of 252) of surveyed EFNEP 6th-8th grade improved in their responses to: Following directions in a recipe?
46% (23 of 50) of surveyed EFNEP 9th-12th grade improved in their responses to: In the last month, if your family did not have enough food, how often did you help by going to a food pantry or finding other free or low-cost food resources?
59% (173 of 289) of surveyed SNAP-Ed adults reported less often running out of food before the end of the month as a result of participating in a SNAP-Ed program.
47% (160 of 337) of surveyed SNAP-Ed adults reported saving money on groceries as a result of participating in a SNAP-Ed program.
Nutrition:
87% (2076 of 2386) of participants indicated they made one or more positive dietary change as a result of completing a program
63% (3397 of 5409) of participants increased average daily consumption of fruit and/or vegetable as a result of completing a program
37% (712 of 1919) of participants increased averaged daily consumption of whole grains as a result of completing a program
42% (727 of 1712) of participants increased average daily consumption of fat free or low fat dairy foods as a result of completing a program
44% (153 of 345) of participants decreased consumption of salt/sodium as a result of completing a program
53% (961 of 1805) of participants decreased consumption of saturated and/or trans fats as a result of completing a program
Childhood Obesity:
For youth EFNEP uses age appropriate evaluation tools with K-2nd using the same tool, 3rd-5th using a different tool, 6-8th using a different tool, and finally 9th-12th is using a different tool. Every state uses the same evaluation tool as required by our Federal partners. Food resource management and food security are only assessed in the 6-8th grades and 9-12th grades, respectively.
For EFNEP youth outcomes:
86% (1666 of 1927) Children and youth improve their abilities to choose foods according to the Federal Dietary Recommendations or gain knowledge
50% (950 of 1909) Children and youth improve their physical activity practices or gain knowledge
For SNAP-Ed Process evaluation is critical because it allows ongoing monitoring of the

program and enables timely refinements which help achieve success. Process evaluation activities include tracking the number of SNAP eligibles and potential eligibles reached, the number of materials distributed at educational displays and the number of events and methods used to reach the target audience. SNAP-Ed reports planned events in the UACES Arkansas Information Management System (AIMS) online electronic reporting system.
Formative evaluation assures the best possible program by identifying appropriate target audiences and ensuring program messages and activities are relevant and meaningful to them. Methods used to evaluate the program include observing participant behavior, informal talks with the participant about the educational activity, giving short surveys, holding group discussions with participants to gain feedback to assess a project as it progresses or to determine improvements and adjustments needed to attain the program objectives.
Outcome/impact evaluation is conducted with direct contact programs. Pre-and post-tests or post-then pre-tests are used to assess knowledge, attitude, and behavior change among youth and adults. A series of evaluation questions are in place for county agents to use to develop appropriate questionnaires that fit their programs and are aligned with UACES outcome/impact indicators.
For SNAP-Ed. Youth evaluations collect information on knowledge gain and diet and physical activity practices.
Youth outcome evaluation measures as a result of participating in a SNAP-Ed program. The number of youth surveyed is not necessarily the same for every outcome indicator. Of youth surveyed:
•73% reported they gained knowledge of MyPlate.
•52% reported they intend to follow MyPlate guidelines.
•46% reported eating closer to the recommended number of cup equivalents from the fruit group most days.
•45% reported eating closer to the recommended number of cup equivalents from the vegetable group most days.
•33% reported eating closer to the recommended number of ounce equivalents of whole grains most days.
•30% reported eating closer to the recommended number of cup equivalents of low fat or fat free foods from the dairy group most days.
•49% reported increasing physical activity or reduced sedentary time.
•72% reported/demonstrated they more often practice desirable personal hygiene such as hand washing.
•48% reported gaining knowledge about foods of which to increase consumption as recommended by the Dietary Guidelines for Americans.
•28% reported gaining knowledge about foods of which to decrease consumption as recommended by the Dietary Guidelines for Americans.
•53% reported understanding the importance of balancing food intake and physical activity.
•35% reported decreasing consumption of sugar sweetened beverages.
•78% reported increased knowledge about Arkansas foods.

Key Items of Evaluation

ServSafe® training is evaluated using pass rates for the ServSafe® Food Safety Program for Managers Exam. Test takers must pass the exam with a minimum a score of 75% to show competency to earn a 5 year ServSafe® Managers Certification.
In 2014 for Arkansas EFNEP 100% of adult graduates and 50% of enrolled youth complete

pre- and post- evaluations. For adults' data is collected using a national tool called the Behavior Checklist. The Behavior Checklist asks a set of 10 plus three additional questions specific to Arkansas EFNEP. Included in the Behavior Checklist and specific to food safety is the Food Safety Domain which includes two questions. For youth EFNEP uses age appropriate evaluation tools with K-2nd using the same tool, 3rd-5th using a different tool, 6-8th using a different tool, and finally 9th-12th is using a different tool. Every state uses the same evaluation tool as required by our Federal partners. Food safety is evaluated for all ages of youth.
For SNAP-Ed evaluation adults are surveyed, frequently using a pre- and post- methodology. SNAP-Ed and 4-H youth evaluations for food safety use a one item survey tool and similar to adults pre- and post- methodology is encouraged.
Nutrition:
# of participants who indicated they made one or more positive dietary change as a result of completing a program
# of participants who increased average daily consumption of fruit and/or vegetable as a result of completing a program
participants who increased averaged daily consumption of whole grains as a result of completing a program
participants who increased average daily consumption of fat free or lowfat dairy foods as a result of completing a program
of participants who decreased consumption of salt/sodium as a result of completing a program
participants who decreased consumption of saturated and/or trans fats as a result of completing a program
Childhood Obesity:
Increase knowledge concerning one or more healthy food/nutrition choice
Adopt one or more healthy food/nutrition practice
Eat nearer to the recommended number of cup equivalents from the Fruit and/or Vegetable Group
Eat nearer to the recommended number of cup equivalents from the Dairy Group
Eat nearer to the recommended number of cup equivalents from the Grains Group
Engage more often in regular physical activity
Adopt one or more desirable food safety habit
Increase ability to balance calories from food and beverages with calories expended