

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Food Safety

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals	5%	0%	0%	0%
501	New and Improved Food Processing Technologies	20%	0%	25%	0%
502	New and Improved Food Products	25%	0%	25%	25%
702	Requirements and Function of Nutrients and Other Food Components	0%	0%	0%	25%
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	25%	0%	25%	0%
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	25%	100%	25%	50%
	Total	100%	100%	100%	100%

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Actual	6.7	0.3	9.5	3.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
254527	93892	178116	665210
1862 Matching	1890 Matching	1862 Matching	1890 Matching
288731	74807	600431	452343
1862 All Other	1890 All Other	1862 All Other	1890 All Other
708136	0	2188528	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Conduct educational classes, workshops, meetings, and trainings, develop products, curriculum, resources, facilitate coalitions and/or task forces, conduct assessments and community surveys, partner with community agencies and institutions to facilitate programs and community development, create/revise social systems and public policies, conduct research studies, disseminate program and research results through papers, reports, and media, develop and implement marketing strategies using various outlets to promote program participation, disseminate research-based information to consumers using a variety of media and technology resources, cooperate with media and other community agencies to seek effective means of reaching new and non-traditional audiences, and respond to consumer inquiries.

2. Brief description of the target audience

Retail and food service employees, retail and food service management, temporary food vendors, child care providers, young adults (ages 25-59), older adults (ages 60 and older), Extension educators, and commercial food processors.

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	{NO DATA}	{NO DATA}	{NO DATA}	{NO DATA}
Actual	11620	18588	955	209

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

Patent Applications Submitted

Year: 2010

Plan:

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	5	14	19

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of food service managers, supervisors and food handling personnel from restaurants, cafeterias, daycare and other food service facilities completing food safety training offered by extension educators in Virginia.

Year	Target	Actual
2010	{No Data Entered}	872

Output #2

Output Measure

- Number of home-based food business workshops conducted for food product formulation, facility planning, food processing and safety, product evaluation, food packaging and labeling, and record keeping.

Year	Target	Actual
2010	{No Data Entered}	3

Output #3

Output Measure

- Number of short-courses provided on food safety practices including HACCP training, Good Agricultural Practices and recall workshops to industry personnel, consumer organizations, Extension Agents and to local, state, and federal health inspectors

Year	Target	Actual
2010	{No Data Entered}	37

Output #4

Output Measure

- Number of home food preservation trainings offered by Extension educators in Virginia

Year	Target	Actual
2010	{No Data Entered}	56

Output #5

Output Measure

- Number of consumers completing safe food handling and preparation classes for civic/community groups and volunteer fund raisers supplying food for large groups of people.

Year	Target	Actual
2010	{No Data Entered}	234

Output #6

Output Measure

- Number of research projects completed or in progress in the area of food safety.

Year	Target	Actual
2010	{No Data Entered}	6

Output #7

Output Measure

- Number of home based business entrepreneurs that have products evaluated for thier safety by the 'Food Processor Technical Assistance Program' to prevent foodborne illness across the commonwealth.

Year	Target	Actual
2010	{No Data Entered}	59

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Increase in the number of food handlers (managers, supervisors, and food handling personnel from restaurants, public school and hospital cafeterias, daycare centers, nursing homes, university food service, correctional centers, civic/community groups and volunteers) who increase knowledge and skills in safe food handling practices.
2	Increase in number of home-based business entrepreneurs that increase awareness and knowledge in producing safe high acid and acidified food products.
3	Increase in number of discoveries from completed food related research projects which focus on enhancing the safety of the Nation's food supply and the development of value added foods.
4	Increase in the number of Virginia Food Producers receiving enhancing their knowledge in safe food production, handling and processing through Good Agricultural Practices, Good Manufacturing and HACCP trainings
5	Improving Farm Hygiene and Produce Sanitization
6	Value-adding Components and Properties of Pomace from Virginia Grown Fruits and Vegetables

Outcome #1

1. Outcome Measures

Increase in the number of food handlers (managers, supervisors, and food handling personnel from restaurants, public school and hospital cafeterias, daycare centers, nursing homes, university food service, correctional centers, civic/community groups and volunteers) who increase knowledge and skills in safe food handling practices.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	494

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Foodborne illness significantly affects public health in the United States and the overall cost to the public is high. The Centers for Disease Control and Prevention estimate there are 76 million cases of foodborne illness per year resulting in 325,000 hospitalizations and 5,000 deaths². The cost of foodborne illness in terms of pain and suffering, reduced productivity and medical expenses is estimated to be between \$10 billion and \$83 billion dollars per year. This equates to an estimated cost between \$131 and \$1,092 per foodborne illness case.

Between 2000 and 2006, the state of Virginia averaged 17 foodborne outbreaks per year resulting in an average of 578 confirmed cases (sick individuals) per year³. For each confirmed case there are an estimated 20-38 unconfirmed cases². Between 11,560 and 21,964 Virginians suffered from foodborne illness each of those years. The estimated economic loss from foodborne illness is between \$1,514,360 and \$23,984,688 per year.

According to the CDC, inadequate cooking, improper holding temperatures, contaminated equipment, poor personal hygiene and food from unsafe sources are the top factors contributing to foodborne illness¹. Safe food handling and preparation by food handlers can dramatically reduce illness and health costs.

What has been done

In 2010 VCE conducted food handler trainings across the state including: 36 manager food safety certification courses (16 hour nationally recognized certification program) were provided to 494 individuals from the food service industry, schools, senior and day care centers across the state; 14 employee food safety certification courses (6 to 10 hour trainings) were provided to 378 individuals were food handlers preparing foods in non-supervisory roles; 12 general safe food handling and preparation courses were provided to 234 individuals. These included consumers preparing foods in their homes, individuals from non-profit organizations such as church, civic groups and public service organizations preparing food occasionally for the public.

Nineteen family and consumer sciences Extension educators provided these programs in over 40 counties across the state. Over 461 restaurants, schools, day care centers, churches, civic groups, public service organizations and other locations sent individuals to VCE to complete food safety training.

Results

Food handler trainings were evaluated to determine the knowledge and behavior changes of participants. Of those who completed pre and post evaluations, 89% increased their knowledge of food safety practices.

132 participants responded to a follow-up survey, for a response rate of 12%. Of respondents, 100% adopted at least one new food safety behavior including, 100% improved time and temperature practices; 100% made changes to prevent food contamination; 100% made changes to personal hygiene practices.

In addition, respondents shared food safety information with 870 additional food handlers.

It is conservatively estimated that if one case of foodborne illness is prevented per food handler completing proper food safety training and application through VCE, this translates into a potential annual savings of between \$145,527.48 and \$1,207,873.66 for the state of Virginia. This savings is calculated from pain and suffering, reduced productivity and medical expenses. This range of economic costs ensures a broad, accurate measure of the potential impacts from food safety programming provided across Virginia.

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

Increase in number of home-based business entrepreneurs that increase awareness and knowledge in producing safe high acid and acidified food products.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	59

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Food processors in Virginia need guidance on formulation and regulation of their products in order to produce safe and wholesome food products that are in compliance with state and federal laws.

What has been done

Food products and processes are analyzed and recommendations for formulation and processing are delivered. Since we are recognized as a Process Authority for acidified foods, food processors who receive guidance through this program are able to file required processing documents with the Food and Drug Administration (FDA).

Participating companies and individuals receive education on the following topics:

- Federal, state and local regulations for processed food products
- Appropriate modifications in formula and/or process to be in compliance with regulations or to otherwise improve the safety and wholesomeness of food products
- Filing and maintenance of required documentation.

Results

In 2010, the Food Processor Technical Assistance Program analyzed 209 products submitted by 59 clients. The products can be categorized as follows:

- 178 products were evaluated to validate the production processes.
- 126 products required a process or packaging change.
- 42 of these products had major safety issues.
- 7 of these products were considered unsafe and were already on the market.
- 41 products were evaluated to determine if the product was a Potentially Hazardous Foods.
- 50 products needed evaluation for FDA compliance.
- 25 products were analyzed to determine if the food product was considered as a formulated acid food.
- 56 nutritional facts labels were computed for producers.

The program also performed the following services for major Virginia Food Companies:

- Process validation for two beef jerky processors - a requirement before the business could be inspected and launched.

Savings to Virginia Food Processors in Direct Costs Associated with Testing and Recommendations:

1. Process Analysis/Thermal Process validation (compared to a well-known Maryland company) base price \$300/product; 178 products x \$300 = \$53,400.
2. Nutritional Analysis Computation (compared to a California based company) - \$495/product 29 labels x \$495 = \$14,355.
3. Consultation for major problems such that safety protocol is applied. Using a base consultation price of \$125/hour and an estimate of 0.5 hours/issue: 126 issues X 0.5 hours x \$125 = \$7,875.
4. Product Development 13 clients in 2010 required extensive product development to launch their products. UGA Department of Food Science offers a product development package which comparable services for \$750/client. 13 clients X \$750 = \$9,750.
5. Consultation for Company Audits (2 companies). Using a base consultation price of \$125/hour and an estimate of 10 hours for issue one and 2 hours for issue two: 10 hours X \$125 = \$1,250.

TOTAL DIRECT COST SAVINGS TO VIRGINIA FOOD COMPANIES IN 2010: \$86,630.
This calculation does not include over 1500 phone calls and emails fielded by this office to individual Virginia residents, VCE agents, VDACS agents and VDH agents.

TOTAL SAVINGS TO THE COMMONWEALTH THROUGH PREVENTION OF FOODBORNE ILLNESS: If each client prevents just one foodborne illness (using Salmonella as a low-cost basis), then the savings is \$120,186 annually.

Botulism is the primary foodborne illness agent of concern in canned foods. If all of the clients assisted in 2009 prevented one case of botulism (collectively), then the savings to the commonwealth is \$100,000.

TOTAL SAVINGS TO VIRGINIA:
Therefore, a conservative estimate of the value of this program to Virginia is approximately \$306,816 annually.

4. Associated Knowledge Areas

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

Outcome #3

1. Outcome Measures

Increase in number of discoveries from completed food related research projects which focus on enhancing the safety of the Nation's food supply and the development of value added foods.

2. Associated Institution Types

- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	13

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The Center for Disease Control and Prevention estimates that there are approximately 76 million cases of foodborne illness each year. Strategies to improve the safety of the food supply and decrease foodborne illness are critical. Additionally, work to improve food quality to extend shelf-life and nutritional content of foods is critical to the Nations ability to address food security and hunger issues. All of these topics are being addressed by research in the College of Agriculture and Life Sciences.

What has been done

Approximately 10 faculty members from the Food Science & Technology Department, Plant Pathology and Weed Science and Biological systems engineering are conducting research in this area. Approximately 13 projects were completed in 2010 with over 14 peer reviewed publications.

Results

Selected discoveries from this work include: Identified extraction and fractionation procedures that result in natural anti yeast compounds from peanut skins; Identified natural compounds that inhibit the formation of benzene in beverages that use sodium benzoate as an anti mold/yeast additive; Identified a natural compound that inhibits the non enzymatic browning of peaches; Using a fixed inactivation level of 3 logs and a fixed quality of 95% best quality, optimal cooking conditions were determined that both provide a high quality product and assure microbial safety of shrimp and Atlantic salmon; Cooking to 74°C is recommended as the internal temperature endpoint when cooking fish/shellfish; Developed Omega-3 enriched beverages that demonstrated physical properties and characteristic of whole milk while delivering 432mg of omega-3 fatty acid per 8oz serving; Developed improved methodology for detection and optimized sample recovery of Campylobacter in poultry processing; Testing of products for mycotoxins has improved the ability of Virginia wheat and barley to compete in national and global markets, and has broadly improved food safety and security in the United States by providing accurate and timely mycotoxin testing services for DON in raw grain.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies

502	New and Improved Food Products
702	Requirements and Function of Nutrients and Other Food Components
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #4

1. Outcome Measures

Increase in the number of Virginia Food Producers receiving enhancing their knowledge in safe food production, handling and processing through Good Agricultural Practices, Good Manufacturing and HACCP trainings

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	630

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Food safety trainings, specifically Good Agricultural Practices (GAPs), Good Manufacturing Practices (GMP?s), Hazard Analysis Critical Control Point (HACCP), sanitation, and allergen controls, continue to address a primary need of food producers in Virginia. In-house custom training programs allows us to focus trainings on issues of concerns by the company, help employees acquire skills and understand how their work function affects the quality and safety of the product. Since high portion of the employees in these industries are Spanish speakers, providing trainings in their native language (Spanish) decreases the chance for misunderstanding of work expectations and allows for the proper application and performance of required duties. Overall, basic understanding and proper application of GMP?s, sanitation and HACCP procedures is the backbone for the production of safe and quality seafood in the USA.

What has been done

One hundred and twenty (120) farmers and sixty (60) USDA farm auditors were trained in Good Agricultural Practices. Eleven (11) custom English and Spanish Good Manufacturing Practices (GMP?s) trainings were developed and delivered to a total of 258 food processing employees, seven (7) English and Spanish HACCP trainings were delivered to a total of 87 employees, two (2) English and Spanish food allergen processing controls trainings to 29 seafood employees and

supervisors, one (1) sanitation control procedures training and one (1) English and Spanish food defense training to 65 were developed and delivered to seafood processing employees in Virginia

Results

The GAPs trainings better prepares the auditors to make farm-level decisions that will result in improved safety of fresh fruits and vegetables. The training also provides the auditors with knowledge to better communicate with farmers who have chosen to become GAPs certified. Bilingual training and materials provided, helped companies employees gained better understanding and application of manufacturing procedures, how to effectively identify and control food safety hazards and prevent contamination of products before it reaches the consumer. Statements excerpted from a follow up survey sent to seafood processors indicated that these trainings "provided a foundation for their success in the business", "helped them pass product protocols due to bilingual training regarding safe food handling, hand-washing, cross-contamination" and "helped meet training requirements by VDHSS, FDA, so that we can continue to produce safe quality food products". Another company indicated that "prior to training they were having unsatisfactory finished product sampling results". After training and recommended procedures were applied, they were able to meet necessary requirements.

4. Associated Knowledge Areas

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

Outcome #5

1. Outcome Measures

Improving Farm Hygiene and Produce Sanitization

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Fresh fruits and vegetables are considered by consumers to be healthful, nutritious foods. However, numerous recent food-borne illness outbreaks have been linked to contaminated produce in the United States. In investigations of such outbreaks, researchers often conclude that contamination likely occurred on the farm or during produce packing, where more effective control strategies are needed.

What has been done

Researchers at Virginia State University have been looking for new and/or alternative approaches to better prevent and eliminate microbial contamination in fresh fruits and vegetables during produce production and handling. Research has been conducted to develop an effective produce sanitization procedure. This study evaluated the efficacies of chlorine dioxide, ozone, organic acids, etc. under various application conditions for produce sanitization and prevention of cross-contamination within washing systems and wash runoff.

Results

Researchers found that spray washing fruits with high-purity chlorine dioxide on roller brushes is an effective method for tomato sanitization on packing lines. This research increased knowledge of microbial ecology with regard to the routes of contamination and intervention. Based on current scientific data, industry groups recognized chlorine dioxide as a valid alternative sanitizer to chlorine in best management practices for tomato packinghouses. Nationally over 60 tomato packing lines (including four Virginia facilities) have now adopted the alternative method for fruit sanitization. The conversion reduced the usage and environmental impact of chlorine, a conventional biocide that may react with organic materials to form potentially carcinogenic compounds.

4. Associated Knowledge Areas

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

Outcome #6

1. Outcome Measures

Value-adding Components and Properties of Pomace from Virginia Grown Fruits and Vegetables

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Pomace is the remaining byproduct from the juice extraction procedure and is mainly comprised of skin and seeds. Pomace extracts could be used to treat chronic diseases such as diabetes which affects more than 20 million Americans.

What has been done

Experiments have been conducted to investigate anti-diabetic properties of 340 fruit and vegetable pomace extracts. Pomace samples were investigated for their ability to inhibit the enzyme, alpha-glucosidases and reduce blood sugar spikes include grape apple, and tomato.

Results

The skin from Norton grape (*Vitis aestivalis*) was the only sample that had an alpha-glucosidase inhibitory effect, and it was similar to Acarbose. The Norton grape skin extract's inhibitory effect began as low as 7.1 equivalent $\mu\text{g/mL}$ ($\mu\text{g eq. mL}$), which is a very low concentration. Scientists then tested 15 grape pomace (skin and seed) extracts grown in Virginia on both yeast and rat intestine for α -glucosidase inhibitory effects. We found that all of the grape pomaces showed inhibition in both models. In the yeast, we found a decrease in activity from 16.3% to 99.5% at 2.5 mg equivalents/mL (mg eq. /mL). In the rat intestinal model we found that 20 (mg eq. /mL) decreased α -glucosidase activity from 14.6% to 75.6%.

Current sales of pharmaceutical alpha-glycosidase inhibitors in the U.S., such as Acarbose and Voglibose, et cetera, total more than \$300,000,000 per year, and tapping into that market could be very lucrative for grape producers. This study has the potential to significantly increase the value of this product that is currently treated as waste by growers and producers of grapes. The potential health and financial benefits of this research can be far-reaching and significant for Virginia and the U.S.

4. Associated Knowledge Areas

KA Code	Knowledge Area
502	New and Improved Food Products

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy

Brief Explanation

Significant budget reductions across the state has resulted in a reduction in Extension educators in VCE. This has resulted in a drop in numbers of participants for many of our

classes.

V(I). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- Retrospective (post program)
- Before-After (before and after program)

Evaluation Results

Evaluation results are described in the outcomes which are provided.

Key Items of Evaluation