V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Food Safety

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
204	Plant Product Quality and Utility (Preharvest)	0%		5%	
306	Environmental Stress in Animals	0%		5%	
308	Improved Animal Products (Before Harvest)	0%		5%	
311	Animal Diseases	0%		10%	
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals	0%		10%	
501	New and Improved Food Processing Technologies	0%		5%	
502	New and Improved Food Products	0%		5%	
701	Nutrient Composition of Food	21%		10%	
702	Requirements and Function of Nutrients and Other Food Components	0%		10%	
703	Nutrition Education and Behavior	22%		10%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	0%		5%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	0%		10%	
723	Hazards to Human Health and Safety	26%		10%	
724	Healthy Lifestyle	26%		0%	
903	Communication, Education, and Information Delivery	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	6.0	0.0	40.0	0.0
Actual Paid	7.7	0.0	10.0	0.0
Actual Volunteer	225.0	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**
175442	0	538874	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
175442	0	3463658	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
342143	0	3376198	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

This program will result in multiple outputs as a result of the following proposed activities:

- Conducting laboratory, pilot-plant experiments and data collection
- Conducting research experiments
- Developing quality monitoring protocols
- Developing and applying new technology of food processing systems
- Developing products, curriculum, resources
- Developing services
- Presenting seminars and professional talks
- Conducting workshops and training sessions
- Publishing scientific findings
- Partnering
- Providing community education classes
- Maintaining a statewide food safety hotline
- Working with and supervising volunteers to deliver high quality information and programming about food safety topics

2. Brief description of the target audience

There are diverse audiences for information this program generates. They can be classified into five general groups: (1) the general public and food consumers; (2) state and federal food regulatory agencies; (3) the research community including scientists working in government, industry, and academic sectors;

(4) the commercial food processing industry and commodity groups; and (5) professional food handlers in organizations such as schools and other institutions, as well as restaurants.

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	3997	2167	1959	3262

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

Patent Applications Submitted

Year: 2014

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	2	40	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Conference Presentations

Year	Actual
2014	39

Output #2

Output Measure

- Number of Courses Developed that include the Planned Program and State Defined Outcomes as part of the curriculum

Year	Actual
2014	4

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Understand nutritional relationships to health, such as * mechanisms behind the health benefits of fruits and vegetables * novel dietary modifications to reduce the incidence of prostate cancer * role of antioxidants from berries in preventing health disease
2	Improve animal food production systems that impact food safety * improve diets to produce safer foods and human benefits * enhance efficacy and safety of vaccination programs * develop diagnostic methods
3	Characterize and model pathogens and toxins in food and food systems * agents, mechanisms * toxicity to animals or humans * mechanisms behind immune suppression
4	Improved food handling and regulations * food production and handling practices. * Intervention strategies reduce bacterial contamination, increase shelf life, and reduce occurrences of food-borne illnesses.
5	Improved animal husbandry that reduced food safety issues
6	Number of specialty food and mainstream food processors accessing and applying science based information to produce and distribute safe, nutritious, high-quality foods.
7	Number of individuals improving their practices of safe food handling, food preparation, and food preservation.
8	Develop technologies and control strategies to improve food safety
9	Detect incidences and trace pathways of food borne illnesses
10	Number of policy makers and managers informed about safe food handling and processing

Outcome #1

1. Outcome Measures

Understand nutritional relationships to health, such as * mechanisms behind the health benefits of fruits and vegetables * novel dietary modifications to reduce the incidence of prostate cancer * role of antioxidants from berries in preventing health disease

2. Associated Institution Types

- 1862 Extension
- 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)
Research shows vitamin B1, also known as thiamine, can boost the immune system of plants, including rice, cucumbers and tobacco. OSU's researchers are hoping that sustained accumulation of thiamine can make rice immune to bacterial leaf blight and rice blast, which cause significant yield losses in Southeast Asia, the world?s top rice-growing region.The results of this research will also see if the rice grain itself contains more thiamine, which is present only in low amounts in white rice. In areas of the world where white rice is the cornerstone of most diets, thiamine deficiencies are common. Thiamine helps create acids for digestion, supports carbohydrate metabolism and is essential for the overall health of the nervous system.

What has been done
Greenhouse work has begun to produce rice crosses with higher levels of B1 and additional breeding work will continue through 2015 to create new varietals with resistance to leaf blight and rice blast.

Results
Preliminary results from this research is expected to be available in 2016.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)

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
723	Hazards to Human Health and Safety
724	Healthy Lifestyle

Outcome #2

1. Outcome Measures

Improve animal food production systems that impact food safety * improve diets to produce safer foods and human benefits * enhance efficacy and safety of vaccination programs * develop diagnostic methods

2. Associated Institution Types

- 1862 Extension
- 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)
Enterotoxin-producing Clostridium perfringens isolates have been associated with C. perfringens type A food poisoning, which currently ranks as the third most commonly reported food-borne illness in the USA. C. perfringens type A food poisoning is acquired when people consume a food (typically a beef or poultry product) contaminated with large numbers of vegetative cells of enterotoxigenic C. perfringens type A isolates. This single food poisoning affects more than 250,000 humans annually, and result in economical losses of over $120 million in the USA. C. perfringens also associated with gastrointestinal diseases in various species of animals. C. perfringens has the ability to form metabolically dormant spores that are extremely resistant to environmental stresses such as heat, radiation and toxic chemicals. However, to cause deleterious effects, dormant spores must first go through germination then outgrowth to be converted to vegetative cells. Although spore germination is a very crucial step for the pathogenesis of C. perfringens, no detail understanding of the mechanism of C. perfringens spore germination is available. Moreover, there are gaps on the fundamental knowledge on inactivation of C. perfringens spores using mild treatments such as, heat and disinfectants.

What has been done

(1) Mechanism of Spore Germination: We performed a study to identify and characterize amino acid germinants for spores of enterotoxigenic C. perfringens type A. One publication appeared from this study as:

Udompijitkul P, Alnoman M, Banawas S, Paredes-Sabja D, Sarker MR. 2014. New Amino Acid Germinants for Spores of the Enterotoxigenic Clostridium perfringens Type A Isolates. Food Microbiology, 44:24-33.

(2) Spore inactivation: In a process of developing spore inactivation strategy, we evaluated the inhibitory effects of organic acid salts, sorbate and benzoate, against C. perfringens type A food poisoning (FP) and non-food-borne (NFB) disease isolates. The results are submitted for publication to Food Microbiology journal and the manuscript is currently under second revision. The title and the abstract of the manuscript are given below:

Maryam Alnoman, Pathima Udompijitkul, Daniel Paredes-Sabja, and Mahfuzur R. Sarker. 2015. The Inhibitory Effects of Sorbate and Benzoate Against Clostridium perfringens Type A Isolates. Food Microbiology. Under revision.

Results

The first step of germination is the binding of germinants to their cognate GRs. Identification of GerKC is the main GR protein for germination of spores of FP strain SM101 with L-cysteine, L-glutamine, and L-asparagine makes this protein of interest for development of inhibitors, since such compounds would block spore germination and thus the ability of spores to cause disease. Germination also makes the now fully germinated spores much less resistant to common decontamination procedures. Consequently, a drug that could rapidly activate spore germination would also be useful, as this would allow decontamination of germinated C. perfringens spores under less harsh conditions than needed for destruction of the more resistant dormant spores.

4. Associated Knowledge Areas

KA Code	Knowledge Area
308	Improved Animal Products (Before Harvest)
311	Animal Diseases
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

Outcome #3

1. Outcome Measures

Characterize and model pathogens and toxins in food and food systems * agents, mechanisms * toxicity to animals or humans * mechanisms behind immune suppression

2. Associated Institution Types

- 1862 Extension
- 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)
Cyprinid herpesvirus 3, or koi herpesvirus (KHV), is a deadly virus that affects koi and carp worldwide. It causes severe gill necrosis and nephritis, dermal ulceration , hemorrhage, and mass mortality of up to 100% of affected fish. Fish that survive KHV infection are latently infected lifelong carriers. Little is known about the molecular mechanisms and control of latency of KHV. Our previous studies have identified ORF6 mRNA is present during latent infection

What has been done
In this study, the expression of a protein from ORF6 mRNA was investigated by a polyclonal antibody specific to a synthetic peptide derived from predicted ORF6 protein (anti-ORF6). By immune fluoresces assay (IFA), positive staining to the anti-ORF6 were observed in both KHV infected CCB cells in vitro and IgM+ B cells from koi latently infected with KHV. No IFA staining was observed in uninfected CCB cell and IgM- B cells from koi latently infected with KHV. The ORF6 protein expressed during productive infection was found to be around 140 KDa, which is bigger than the predicted protein, ~80 KDa. The ORF6 protein at similar size as the predicted protein can be produced in an expression vector of pet6XHN in E Coli. Based on software GPS-SUMO analysis, 5 potential sumoylation sites were identified in the ORF6 proteins. Our study demonstrated that ORF6 protein is expressed during latency and may be sumoylated in infected cells.

Results
This is the first demonstration that a member of the Alloherpesviridae, cyprinid herpesvirus 3 (CyHV-3), express a viral protein, ORF6 protein, during latency. The protein appears to be around 140 kDa in molecular mass and may be sumoylated or modified post-transnationally. ORF6

protein has homology to a conserved domain of EBNA-3B from Epstein Barr Virus and ICP4 from Herpes simplex virus 1, which are genes important for latency. Our results suggest that ORF6 protein may have a potential regulating role in KHV latency

4. Associated Knowledge Areas

KA Code	Knowledge Area
308	Improved Animal Products (Before Harvest)
311	Animal Diseases
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
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
723	Hazards to Human Health and Safety

Outcome #4

1. Outcome Measures

Improved food handling and regulations * food production and handling practices. * Intervention strategies reduce bacterial contamination, increase shelf life, and reduce occurrences of food-borne illnesses.

2. Associated Institution Types

- 1862 Extension
- 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)
In 1996, the USDA began an ambitious program to replace a generation of highly toxic pesticides with less environmentally harsh alternatives. Terminating the use of potent broad-spectrum pesticides would be safer for people but tough for business. Developing, manufacturing, and

registering pesticides targeted to a specific crop is expensive work required by U.S. law. Therefore, companies often choose to focus on major crops. But in the language of industry, all but a handful of Oregon?s 220 commercially grown crops are considered minor. Few pesticides are developed specifically for, say, turnips. So when turnip growers need a safe and effective product to control aphids, they turn to North Willamette researchers.

What has been done
Research on pesticide alternatives is being conducted at the IR-4 Field Research Center at NWREC, which is Oregon?s part of the Interregional Project No. 4, a federal program to help producers find pest management tools for minor crops. From pumpkins to hops, these minor crops are major contributors to Oregon?s economy. DeFrancesco provides the research required by the Environmental Protection Agency to label pesticides for crops that are generally too limited in scale to be profitable for pesticide manufacturers to research on their own.

Results
The goal of the program is to provide growers with alternatives. IR-4 has helped register many of the Bt products organic growers rely on. Researchers assure growers and regulators that pest management should be thoughtful and integrated, using cultural and biological methods, in addition to the judicious use of chemicals. This work ensures safe, high-quality produce for consumers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
501	New and Improved Food Processing Technologies
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
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
723	Hazards to Human Health and Safety
724	Healthy Lifestyle

Outcome #5

1. Outcome Measures

Improved animal husbandry that reduced food safety issues

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Traditional cattle feed mixtures of corn, grains, alfalfa hay and grass silage result in dairy products with low concentrations of omega-3 and other polyunsaturated fats. As meat consumption continues to increase, this study evaluated the use of flax seed as a feed supplement to increase omega-3 and poly-unsaturated fatty acids and reduce saturated fats.

What has been done
en pregnant cows at OSU's dairy were fed different amounts of flaxseed ? up to seven percent of their daily diet. Researchers attempted to pinpoint the amount of flaxseed that would maximize the amount of omega-3 in milk and dairy products without negatively affecting their production and texture.Collaborators in OSU's food science and technology department assisted in turning milk into butter and fresh cheese, which were then tested for texture and nutritional composition.

Results
The study found that feeding cows up to six pounds of extruded flaxseed improved the fat profile without negatively affecting the production and texture of the milk and other dairy products. Extrusion presses raw ground flaxseed into pellets with heat.

At six pounds per day, saturated fatty acids in whole milk fat dropped 18 percent, poly-unsaturated fatty acids increased 82 percent, and omega-3 levels rose 70 percent compared to feeding no flaxseed. Similar improvements were observed in butter and cheese.

Still, saturated fat accounted for more than half of the fatty acids in the dairy products while the increase in polyunsaturated fats compromised no more than nearly nine percent of the total.

4. Associated Knowledge Areas

KA Code	Knowledge Area
308	Improved Animal Products (Before Harvest)
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
724	Healthy Lifestyle

Outcome #6

1. Outcome Measures

Number of specialty food and mainstream food processors accessing and applying science based information to produce and distribute safe, nutritious, high-quality foods.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Workers at Oregon?s nurseries are on the front line in making sure their plants are healthy. But some don?t speak English, have limited education, and don?t have formal training in horticulture. So if they come across an infected plant, they might not be able to diagnose the cause or understand why it?s important to tell their supervisor so any potential spread of disease can be curtailed. If action isn?t taken, sick plants can mean lost income for nurseries.

What has been done
In classes offered primarily in Spanish, nursery workers are taught how to prevent the introduction and spread of diseases and pests. Researchers tour greenhouses and fields with employees, pointing out potentially problematic areas. The researcher and employees then develop a list of best practices. For example, workers learn not to overwater to prevent Phytophthora and Pythium water molds. Workers are advised to space plants out so air can circulate and dry any water on the leaves. The researcher also encourages them to water in the morning when it?s cooler, so dangerous spores don?t germinate. Additionally, the workers are taught to sanitize their tools, like clippers, which can transmit microorganisms from one plant to another. Employees also learn about the importance of disinfecting pots before reusing them, and why reusing untreated water could spread diseases.

Results
Since starting these workshops in 2010, researchers have trained more than 340 people from 24 businesses. About 40 of these employees were from two Christmas tree farms. They learned to

scout for and address problems like root rot, aphids, and fungi. Researcher Santamaria shared with them a bilingual pocket guide that she co-authored called ?Identifying and Managing Christmas Tree Diseases, Pests, and Other Disorders.?

The research has also helped berry growers prevent outbreaks of foodborne illnesses. Through workshops in Spanish and English, more than 300 contractors, farm owners, and managers have been trained on how to teach their own fieldworkers about preventing contamination during the harvest season. The trainings were in response to a 2011 outbreak of E. coli caused by deer droppings on an Oregon strawberry farm. Seven people were hospitalized and an elderly woman died.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
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
723	Hazards to Human Health and Safety
724	Healthy Lifestyle
903	Communication, Education, and Information Delivery

Outcome #7

1. Outcome Measures

Number of individuals improving their practices of safe food handling, food preparation, and food preservation.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The implementation of the Food Safety and Modernization Act (FSMA) will have a major impact on agriculture, especially small farms throughout the U.S. It requires new harvest and post-harvest handling practices and record keeping that minimize the risk of food-borne disease hazards. Small farms are artisanal in nature, have 1-5 employees and lack the capital (human and financial) to adopt such a system on their own. A critical need exists for development of a cost effective and simple-to-implement Food Traceability System (FTS) for small producers and processors

What has been done
Researchers organized and participated in a Pesticide Risk Assessment and Risk Reduction Workshop held in Algiers, Algeria, December 15-18, 2013. The workshop was sponsored by the Foreign Agricultural Service (FAS) of the United States Department of Agriculture (USDA), with funding support from the United States Department of State. Its purpose was to provide and opportunity for countries in the region (Algeria, Egypt, Jordan, Morocco, Tunisia, and Yemen) to better understand the risk assessment processes being followed in the region, as well as the process used in the United States; a major focus of the workshop was pesticide regulation to meet international trade, food safety and security goals.
Researchers held workshops in 3 Oregon locations with stakeholders (growers and processors) to explain and discuss new FDA FSMA proposed Rules. Held organizational meetings with internal and external stakeholders to leverage funding for activities to support our ongoing work. Training was provided to the food industry through workshops on HACCP as well as the better process control school. Held workshop to cover the changes and amendments to the FDA Food Safety and Modernization Act.

Participated as an instructor in workshops aimed at teaching good aquaculture practices, good fishing vessel practices and seafood safety practices, the latter being required by FDA regulation, to an international processors and government inspectors in Indonesia and Ecuador. A specific segment in both workshops is focused on issues with traceability. Work directly benefits attendees as they obtain certification for the instruction they receive that is recognized by FDA. Work indirectly benefits FDA by helping to reduce seafood safety hazards imported into the country. It also indirectly benefits US consumers since 90% of all seafood consumed in the US is imported. Work in this area has directly benefited the faculty in better understanding how product is produced and processed at international sites, which aides in understanding issues with traceability and understanding CTEs and KDEs.

Results
Producers, food processors, workers, and consumers are becoming better informed about food safety and traceability and compliance is greatly improved. The program will be expanded further next year across Oregon and in several foreign countries.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other

	Hazards Affecting Animals
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
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
723	Hazards to Human Health and Safety
724	Healthy Lifestyle
903	Communication, Education, and Information Delivery

Outcome #8

1. Outcome Measures

Develop technologies and control strategies to improve food safety

2. Associated Institution Types

- 1862 Extension
- 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)
Pacific Northwest growers of tall fescue and perennial ryegrass straw provide an important source of forage for livestock producers in the Far East and Middle East.Fescue toxicosis and perennial ryegrass staggers are two of the most common toxic plant diseases plaguing livestock in the United States, and result from consumption of forage containing the endophyte-produced mycotoxins ergovaline and lysergic acid (fescue toxicosis) and lolitrem B (ryegrass staggers). It is estimated that the toxicological effects of ergot and lolitrem alkaloids cost between $0.5 and $1 billion in livestock losses annually in the United States alone.

What has been done

Work has progressed on understanding how these mycotoxins elicit clinical signs which impact livestock production including decreased weight gain and diminished reproductive performance. In addition, we have begun delineating the metabolism of these toxins in animals so that a better risk assessment can be conducted which evaluates the presence of these toxins and their metabolites in by-products available for human consumption. Research on these toxins is warranted, as the possible impact of bioaccumulation of these toxins under varying exposure conditions on both toxicity and as residues in food products has not been thoroughly investigated and could affect the manner by which these compounds are regulated.

Results
This past year the industry shipped over 33,000 containers for a total of $350M. Since these tests to insure safe feed started in 2000, the number of clinical cases of endophyte disease seen in Japan has dropped from 54,000 cases in 2000 to zero cases over the past four years.
infected perennial ryegrass (Lolium perenne) with high levels of lolitrem B. HPLC-fluorescent analytical methods for these mycotoxins are described and were used to determine threshold levels of toxicity for ergovaline and lolitrem B in cattle, sheep, horses, and camels. In addition, six clinical cases in cattle are presented to illustrate diagnosis of these three diseases. Our experiment confirmed that lolitrem B is not secreted in bovine urine, and that lysergic acid can be detected in bovine urine in a dose-dependent manner. The tendency for lysergic acid to be excreted in aqueous matrices raises concerns for human consumption of milk products from exposed animals.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
308	Improved Animal Products (Before Harvest)
311	Animal Diseases
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
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
723	Hazards to Human Health and Safety

Outcome #9

1. Outcome Measures

Detect incidences and trace pathways of food borne illnesses

2. Associated Institution Types

- 1862 Extension
- 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)
While traditional food safety methods rely mostly on chemical preservatives to combat disease microbes, OSU researchers are searching for natural ingredients that do the same thing. These approaches are revolutionizing the food industry by providing alternative uses for foods while cutting production costs.

What has been done
Research has been directed at using a series of obstacles that will cumulatively wear down microbes without using chemicals and without affecting the quality of the food product. Simple treatments such as heating slightly or decreasing moisture content can stress microbes and inhibit their growth. Natural antimicrobials can provide a final blow.

Results
Research has focused on a group of bacterial proteins, called bacteriocins, that have the ability to destroy bacteria. One well-studied bacteriocin called nisin attacks bacteria that can cause deadly outbreaks of food poisoning, such as botulism and listeria. Searching for new uses, OSU researchers found that coating food processing equipment with nisin can help prevent microbial spoilage. They found that nisin, as well as an enzyme called lysozyme, which occurs naturally in egg whites, can function as effective natural preservatives in beer and wine.

Electrolyzed water has been discovered as a powerful antimicrobial agent for fresh vegetables and researchers have found that anything with strong sensory response is a likely candidate to have antimicrobial properties?spices, garlic, orange peels, even sauerkraut. And by using one kind of food to preserve another kind of food, this research circumvents the costly process of chemical development and testing. The cost of developing a food-based preservative, for example, can be one-tenth the cost of chemical additive development. And developing alternative uses for existing food products adds value with no extra cost.

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
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
723	Hazards to Human Health and Safety
724	Healthy Lifestyle

Outcome #10

1. **Outcome Measures**

Number of policy makers and managers informed about safe food handling and processing

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Future lifestyles will emphasize maintaining health and preventing diseases that now limit human lifespan. As our understanding of the complex relationships between diet and health expands, markets will grow for safe, highly nutritious foods and for functional foods and biopharmaceuticals that have disease prevention and health promotion effects. Our existing strengths in areas such as biotechnology and genomics, agricultural production systems, food processing and food safety, environmental toxicology and agricultural marketing, trade, and economics position the Oregon Agricultural Experiment Station to

further understand and develop the agriculture and food system in Oregon and the region. A combination of conventional, organic, and biotechnology-based approaches will provide an array of strategies for sustainable production of nutritionally enhanced crops and food. These agricultural and food products will ensure a range of marketing niches for producers while providing the consumer with robust choices within a safe and secure food system. Research will support producers and marketers in the production of certified organic and health-enhanced foods. Research will also provide analyses of health effects of agricultural and environmental chemicals as well as the use of foods and phytonutrients to maintain well-being. Expanded consumer education about the relationships of food, nutrition, and health will provide U.S. citizens with information for making individual choices among an array of foods and food products.

Key Items of Evaluation

This AFRI Challenge Area promotes and enhances the scientific discipline of food safety, with an overall aim of protecting consumers from microbial and chemical contaminants that may occur during all stages of the food chain, from production to consumption. This requires an understanding of the interdependencies of human, animal, and ecosystem health as it pertains to food-borne pathogens. The long-term outcome for this program is to reduce food-borne illnesses and deaths by improving the safety of the food supply, which will result in reduced impacts on public health and on our economy.
In 2014, Food Preservation programming was reported in 27 counties. There are 12 active Master Food Preserve/Family Food Education programs at this time. Most of those encompass more than one county. 382 new and veteran MFP/FFE volunteers contributed over 25,524 hours of time in 21 counties, including: Central Oregon (Deschutes, Crook, Jefferson), Clackamas, Coos/Curry, Douglas, Hood River/Wasco, Jackson/Josephine, Klamath, Lane, Linn/Benton, Marion/Polk/Yamhill, Tillamook, Wallowa and Washington/Multnomah. They educated the public about safe food handling and preservation over the phone, at workshops, and at exhibits and demonstrations at sites such as farmers' markets and county fairs. Over 41,000 contacts were made by volunteers, faculty and Extension staff in throughout Oregon, with 3,041 of these from callers throughout Oregon receiving assistance from the Food Safety/Preservation Hotline. The Hotline is operated with volunteer assistance during the food preservation and holiday season. In addition, over 260,000 Oregonians were reached by our faculty and volunteers through radio and television broadcasts, social media sites, and newspaper articles related to food safety and food preservation topics.