

**Produce Research Funded by the National Integrated Food Safety Initiative (NIFSI) of the
Cooperative State Research, Education, and Extension Service
Fiscal Years 2000-2007**

FISCAL YEAR 2000

Arkansas

Title: Improving Microbial Safety and Shelf-Life of Fresh Produce with Antimicrobial Films

Principal Investigator: N.S. Hettiarachey, Ph.D.

Institution: University of Arkansas

2650 N. Young Avenue

Fayetteville, AR 72704

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Email: qweldema@comp.uark.edu

Project Start Date: 10/1/00

Duration in Months: 36

Award: \$403,994

Description: This study will attempt to control and eliminate pathogens in fresh and lightly processed fruits and vegetables by using natural edible proteins such as those from milk whey, soy or wheat. These films would coat these foods to protect them against contamination during preparation and transportation. To further increase the safety of these foods, the films will have incorporated into them some natural antibacterial proteins produced by dairy and meat starter cultures.

Indiana

Title: Novel Methods to Sanitize Fruits and Vegetables Using Chlorine Dioxide Gas

Principal Investigator: Richard Linton, Ph.D.

Institution: Purdue University

1180 Food Science Building

West Lafayette, IN 479071160

Phone: (765) 494-6481

Fax: (765) 494-7953

Email: lintonr@foodsci.purdue.edu

Project Start Date: 10/1/00

Duration in Months: 36

Award: \$427,435

Description: The goal of the project is to determine the efficiency of ClO₂ gas on inactivation and inhibition of significant pathogenic and spoilage microorganisms in apples, strawberries, cantaloupe, lettuce, and mushrooms.

Iowa

Title: Safety, Quality, and Sustainability of Small-Farm Production of Apples and Cider

Principal Investigator: Cheryl Reitmeier, Ph.D.

Institution: Iowa State University

2312 Food Sciences Bldg.

Ames, IA 50011-1061

Phone: (515) 294-4325

Fax: (515) 294-8181

Email: creitmei@iastate.edu

Project Start Date: 10/1/00

Duration in Months: 36

Award: \$512,061

Description: The goal of this project is to strengthen the economic viability of apple growers and cider processors as the quality and safety of their products are enhanced. This project takes an integrated approach to solving the interlocking problems of fresh apple and cider safety, environmental stewardship, economics, and federal regulations as they impact the sustainability of rural apple producers and rural communities.

Michigan

Title: Chemiluminescence Detection of Microbial Contaminants on Fresh Produce

Principal Investigator: Evangelyn Alocilja, Ph.D.

Institution: Michigan State University

204 Farrall Hall

East Lansing, MI 488241323

Phone: (517) 355-0083

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Email: <http://www.egr.msu.edu/~alocilja>

Project Start Date: 10/1/00

Duration in Months: 36

Award: \$325,284

Description: This research project will validate the membrane immunoassay chemiluminescence (MIC) system for the quick detection of *E. coli* O157:H7 and *Salmonella typhimurium* on contaminated fresh fruits and vegetables, and extend the techniques learned from research to undergraduate instruction and prototype development for feasibility testing with partnering industry. If successful with the *Salmonella* and *E. coli* models, the system can be adapted for other pathogens of concern.

New York

Title: Reducing Microbial Hazards in Raw Produce through Farm Worker Education

Principal Investigator: Robert Gravani, Ph.D.

Institution: Cornell University

412 Stocking Hall

Ithaca, NY 14853

Phone: (607) 254-3262

Fax: (607) 254-4868

Email: rbg2@cornell.edu

Project Start Date: 10/1/00

Duration in Months: 36

Award: \$596,627

Description: Farm and packinghouse workers are important in the production of safe fruits and vegetables but they are also a potential source of contamination. Few, if any programs have addressed food safety and hygiene issues with farm workers. The overall objective of this project is to develop a comprehensive, yet practical and meaningful, education and training program for this important audience.

North Carolina

Title: Fresh Produce Food Safety Training Program for the Southeast

Principal Investigator: Douglas Sanders, Ph.D.

Institution: North Carolina State University

230 Kilgore Hall

Box 7609

Raleigh, NC 27695

Phone: (919) 515-1222

Fax: (919) 515-2050

Email: doug_sanders@ncsu.edu

Project Start Date: 10/1/00

Duration in Months: 24

Award: \$539,512

Description: Produce handlers will acquire the knowledge and skills to establish effective HACCP- type programs in their facilities. An Interagency Food Safety Team will be formed in all the states of the region in order to be prepared to provide accurate information to the news media and family physicians in the event of an outbreak of foodborne illness.

Virginia

Title: Internalization of *E. coli* in Apples under Field and Laboratory Conditions

Principal Investigator: Merle Pierson, Ph.D.

Institution: Virginia Polytechnic Institute

Food Science and Technology Building

Blacksburg, VA 24061

Phone: (540) 231-5281

Fax: (540) 231-2923

Email: piersonm@vt.edu

Project Start Date: 10/1/00

Duration in Months: 24

Award: \$342,601

Description: This project will provide a scientific basis for determining if, how, and when there is internalization of apples by human pathogens such as *Escherichia coli* O157:H7. The techniques that are developed in this study can be used for the examination of similar phenomena

in other fruits and vegetables. Results from this project will provide valuable information to develop effective control procedures in apple production, harvesting, storage, and utilization.

FISCAL YEAR 2001

New York

Title: Strengthening the National Good Agricultural Practices (GAPS) Program through Expanded Collaboration, Research, and Economic Modeling

Principal Investigator: Robert B. Gravani, PhD

Institution: Cornell University

Ithaca, NY 14853

Phone: (607) 255-3262

Fax: (607) 255-4868

Email: rbg2@cornell.edu

Project Start Date: 09/15/01

Duration in Months: 36

Award: \$399,996

Description: The objective of this project is to reduce microbial risks in fruits and vegetables through good agricultural practices (GAPS), to determine the efficacy of antibacterial cotton gloves for reducing contamination of microorganisms on produce, and to develop spatial models to evaluate the economic impact of implementing GAPS on the farm.

FISCAL YEAR 2002

California

Title: Enhancing the Microbial Safety of Fresh and Fresh-Cut Melon

Principal Investigator: Trevor V. Suslow, PhD

Institution: University of California - Davis

148 Asmundson Hall

Davis, CA 95616

Phone: (530) 754-8313

Fax: (530) 752-9659

Email: tvsuslow@ucdavis.edu

Project Start Date: 09/30/02

Duration in Months: 48

Award: \$370,820.00

Description: University of California researchers will evaluate the efficacy of using sanitizers and disinfectants to kill harmful bacteria in melons and other produce.

California

Title: Assessing Risk Factors for the Persistence of *Salmonella Enteritidis* Phage Type 30 in Almond Orchards

Principal Investigator: Linda J. Harris, PhD

Institution: University of California - Davis

One Shields Avenue

Davis, CA 95616-8671

Phone:(530) 754-9485
Fax: (530) 752-4759
Email: ljharris@ucdavis.edu

Project Start Date:09/30/02
Duration in Months: 36
Award: \$572,264.00

Description: The University of California, Davis will assess risk factors that lead to *Salmonella enteritidis* in almond orchards.

Georgia

Title: Produce Safety & Biosecurity - A Multi-State Research, Education, and Extension Initiative

Principal Investigator: Mark A. Harrison
Institution: University of Georgia
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Athens, GA 30602-7610
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E-mail: mahfst@arches.uga.edu

Project Start Date: 09/15/02
Duration in Months: 36
Award: \$568,370.00

Description: The University of Georgia will assess potential vulnerabilities or weaknesses of Good Agricultural Practices and Hazard Analysis and Critical Control Points (HACCP) plans used by the fresh produce industry.

FISCAL YEAR 2003

Indiana

Title: Use of gfp and lux to Track Pathogen Contamination, Growth and Inactivation on Produce Contaminated via Manure/Water (Farm to Fork)

Principal Investigator: Bradley Reuhs
Institution: Purdue University
500 Central Avenue
West Lafayette, Indiana 47907-2022
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Email: breuhs@purdue.edu

Project Start Date: 9/30/2003
Duration in Months: 36
Award: \$500,000.00

Description: Researchers at Purdue University will improve food safety by applying laboratory research tools that detect and track contamination and growth of pathogenic bacteria in foods.

New York

Title: Global Good Agricultural Practices Conference to Explore the Impact of Current Research and Extension Programs

Principal Investigator: Robert Gravani

Institution: Cornell University

11 Stocking Hall

Ithaca, New York 14853

Telephone: (607) 255-3262

Fax: (607) 254-4868

Email: rbg2@cornell.edu

Project Start Date: 9/30/2003

Duration in Months: 24

Award: \$50,000.00

Description: Researchers at Cornell University will conduct a global conference to provide state-of-the-art scientific data on GAPS (Good Agricultural Practices) that improve the microbiological safety of fresh fruits and vegetables.

FISCAL YEAR 2004

Georgia

Title: Improving the Efficacy of Sanitizers on Fresh Produce and Produce Processing Surfaces Using Electrostatic Sprays

Principal Investigator: Yen-Con Hung

Institution: University of Georgia

Griffin Campus

Department of Food Science

1109 Experiment Street

Griffin, Georgia 30223-1797

Telephone: 770-412-4739

Fax: 770-412-4748

E-mail: yhung@uga.edu

Project Start Date: 09/01/04

Duration in Months: 24

Award: \$316,667.00

Description: Researchers at the University of Georgia will improve the efficacy of fresh fruit and vegetable sanitizers by using electrostatic sprays to inactivate pathogenic microorganisms on the surfaces of fresh produce and processing equipment, and provide information to the fresh and fresh-cut produce industry through outreach activities.

Indiana

Title: Improving the Safety of Fresh Fruits and Vegetables with Chlorine Dioxide Gas Using a Miniaturized Industrial-Size Tunnel System

Principal Investigator: Richard Linton

Institution: Purdue University Department of Food Science

745 Agriculture Mall Drive

West Lafayette, Indiana 47907-2009

Telephone: 765-494-6481

Fax: 765-494-7953

E-mail: linton@purdue.edu

Project Start Date: 09/15/04

Duration in Months: 36

Award: \$599,790.00

Description: Researchers at Purdue University will investigate microbial inactivation kinetics for produce pathogens to evaluate the efficacy of using gaseous chlorine dioxide (ClO₂) treatments for potential industry application.

FISCAL YEAR 2006

California

Title: Novel Gaseous Chlorine Dioxide Treatments for Disinfection of Lettuce and Leafy Greens to Enhance Food Safety and Preserve Quality

Principal Investigator: Trevor V. Suslow

Institution: University of California, Davis

One Shields Avenue

Davis, CA 95616

Telephone: 530-754-8313

Fax: 530-752-9659

E-mail: tvsuslow@ucdavis.edu

Start Date: 9/1/2006

Duration: 24 months

Award: \$500,435

Description: This project will evaluate the effectiveness of using chlorine dioxide (ClO₂) gas to disinfect minimally-trimmed and fresh-cut leafy vegetables.

New York

Title: Good Agricultural Practices Online Produce Safety Course

Principal Investigator: Elizabeth A. Bihn

Institution: Cornell University

Department of Food Science

Ithaca, NY 14853

Telephone: 607-254-5383

Fax: 607-254-4868

E-mail: eab38@cornell.edu

Start Date: 9/15/2006

Duration: 36 months

Award: \$598,861

Description: This project will create an online course for individuals involved in the production of fresh fruits and vegetables. The Good Agricultural Practices Online Produce Safety Course (GAPs OPSC) will include information on foodborne illnesses associated with fresh produce, microorganisms of concern in production agriculture, and the implementation of Good Agricultural Practices to reduce microbial risks.

FISCAL YEAR 2007

Georgia

Title: A Systems Approach to Minimize Escherichia Coli O157:H7 Food Safety Hazards Associated with Fresh- and Fresh-cut Leafy Greens

Principal Investigator: Michael P. Doyle
Institution: University of Georgia
Center for Food Safety
Griffin, GA 30223
Telephone: 770-228-7284
Fax: 770-229-3216
E-Mail: mdoyle@uga.edu

Start Date: 9/1/2007
Duration: 48 months
Award: \$ 2,500,000

Description: A multi-institutional research team will obtain data to enable development of risk mitigation strategies to minimize E. coli (O157) contamination of leafy greens.

Ohio

Title: Integrating Social and Biological Sciences to Enhance Adoption of Vegetable Safety Behaviors from Farm to Table

Principal Investigator: Jeffrey LeJeune
Institution: Ohio State University
Food Animal Health Research
Wooster, OH 44691
Telephone: 330-263-3739
Fax: 330-263-3677
E-Mail: lejeune.3@osu.edu

Start Date: 9/1/2007
Duration: 48 months
Award: \$ 2,500,000

Description: Researchers at Ohio State hypothesize that understanding the mental models of individuals involved in vegetable production and handling will elucidate barriers to adoption of safe food handling practices. These barriers can then be addressed by providing information and tools needed to enhance decision-making concerning this increasing risk.

Produce related awards and summary / CRIS reports for 2007; Food Safety 32.0 A.

2	OUTST	3116	Sharon Berk / Maria Brandl,	Tenn Tech U. / USDA- ARS- Albany	Interactions of Salmonella enterica and E. coli 0157:H7 with Protozoa from Fresh Produce	Str.Std.,Renewal
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Our ability to develop good agricultural practices and controls to reduce contamination of fresh produce relies on identifying critical elements for growth and survival of human pathogens in the produce production environments. Protozoa, common in soil, fresh produce and aquatic environments such as irrigation water and flume water, can harbor pathogenic bacteria, and are key factors in virulence and persistence of air-borne pathogens. The role of protozoa in survival and virulence of food-borne pathogens has not been addressed to date; however, we previously revealed that protozoa are abundant on fresh produce, and that *Tetrahymena* sequesters *Salmonella enterica* within expelled vesicles, thereby enhancing the pathogen's survival in fresh and chlorinated water. For the present proposed study, we will investigate the interaction of *S. enterica* and *E. coli* O157:H7 with *Tetrahymena* and the effect of containment in vesicles on the survival of the pathogens to desiccation, UV irradiation, and food sanitizer stress. Survival will be assessed *in vitro* by viability assays using epi-fluorescence microscopy, and on lettuce by population dynamics. In order to better understand the role of pathogen/protozoan interaction in virulence and persistence of the pathogens, microarray analysis will be used to identify genes induced in the pathogens while they reside in vacuoles of *Tetrahymena*. Finally, amoebae isolated from packaged spinach will be examined with the pathogens to determine the presence and persistence of the pathogens in amoebal cysts. This work will address the CSREES strategic goal of enhancing protection and safety of the Nation's food supply.

7	HIGH	2085	Linda Saif // J. Lindbo, T. Meulia, A. Yousef, V. Costantini	Ohio State University Research Foundation	Attachment, uptake, dissemination and inactivation of foodborne enteric caliciviruses in vegetables	Std., New
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INVESTIGATOR: Saif, L. J.

PERFORMING INSTITUTION:
FOOD ANIMAL HEALTH RESEARCH PROGRAM
OHIO STATE UNIVERSITY
1680 MADISON AVENUE
WOOSTER, OHIO 44691

ATTACHMENT, UPTAKE, DISSEMINATION AND INACTIVATION OF FOODBORNE ENTERIC CALICIVIRUSES IN VEGETABLES

NON-TECHNICAL SUMMARY: Our goal is to reduce the incidence of food-borne illnesses due to consumption of fruits and vegetables contaminated with human enteric viruses,

particularly enteric **caliciviruses** such as noroviruses and sapoviruses. The risk of illness associated with consumption of raw food products can be reduced by preventing contamination, or by removing or killing the pathogenic microorganism. A better understanding of the interaction between the virus and the surface of fruits and vegetables or the internalization of virus into plants will be useful to develop new strategies to prevent contamination or to remove human viral pathogens at pre or post-harvest stages from production to consumption.

OBJECTIVES: Pre-harvest: 1) Study the uptake and systemic dissemination of noroviruses (NoVs) and sapoviruses (SaVs) within vegetables (lettuce) by using a cell culture adapted porcine enteric calicivirus (TC/PoSav) and human NoV (HuNoV) capsid virus-like-particles (VLPs). 2) Study binding specificity of NoVs to vegetable surfaces (lettuce) using HuNoV VLPs. Post-harvest: 3) Study virus attachment, survival, and the effect of different treatments to inactivate virus by infectivity assays using the TC/PoSav as a surrogate of NoV.

APPROACH: We will expose vegetables (via leaves or roots) to the cell culture adapted porcine enteric calicivirus (TC/PoSav) and HuNoV VLPs using these as surrogates for HuNoV to determine the existence and nature of virus or VLP binding or uptake into minimally processed vegetables (lettuce). Immunofluorescence assays will be used to detect virus or VLP binding to plant surfaces. We will use cell culture infectivity and RT-PCR assays to quantitate infectious TC/PoSav or viral RNA, respectively, within tissues of washed plants and ELISA to quantitate internalized VLPs. To determine if NoV VLP binding to lettuce is mediated by carbohydrates, similar to the known binding of NoVs to histo-blood group antigens in humans, we will first determine if related carbohydrates are present in lettuce. If present, we will use specific antibodies against such carbohydrates, or broadly reactive plant lectins that bind carbohydrates to block VLP attachment and evaluate these as potential methods to prevent NoV attachment to lettuce. Finally we will evaluate the effect of different chemical treatments to inactivate or reduce virus titers in lettuce by infectivity assays using TC/PoSav. Inactivating agents will include chlorine bleach, hydrogen peroxide and aqueous/gaseous ozone.

PROJECT CONTACT:

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				USDA- ARS- Riverside / Univ. of WI - Milwaukee	Impacts of Irrigation Water Quality on the Persistence and Transmission of <i>E. coli</i> O157:H7 from soil to plants	Std., New
8	HIGH	3112	A.M. Ibekwe / C-H. Yang			

Project Summary

E. coli O157:H7 has been a particular problem to public health and a serious economic issue to many growers. The strain that caused September's spinach outbreak, which killed three and sickened about 200, may have been found in cattle feces near a California spinach field and in wild pigs that roamed through it. Our long term goal is to collect basic ecological and biological data on the persistence of *E. coli* O157:H7 in soil and the transmission of the pathogen through irrigation water to plants. This data will be used to develop transmission/survival models that can be used to devise control measures for the

human illnesses caused by these bacteria. This proposal has four main objectives. First, investigate the population dynamics and rate of spread of *Escherichia coli* O157:H7 to plants with various salinity, temperature, moisture, relative humidity, soil types, etc regimes in the field/lysimeters, and growth chamber using different irrigation methods. Secondly, utilize chromosomally *gfp* strain to determine persistence of the pathogen under different environmental conditions, and fluorescence-activated cell sorter (FACS) technologies to determine genes that are expressed by *E. coli* O157:H7 cells on rhizosphere under field and laboratory conditions. Third, construct knock-out mutations in *E. coli* O157:H7 genes that are specifically expressed on the rhizosphere and test their involvement in rhizosphere survival and interactions with indigenous rhizosphere/soil microflora. Finally, use multivariate statistical analyses to develop predictive models for risks of *Escherichia coli* O157:H7 levels on plants grown under field in a volumetric lysimeter system (VLS) condition.

14	HIGH	1967	Marilyn Erickson / M. Doyle, X. Jiang	Univ of Georgia, Clemson Univ	Defining parameters to eliminate pathogens in composted animal manures for application to produce fields	Std., New
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Project Summary

Composting is a process whereby organic matter is decomposed by microorganisms to generate a stable amendment that improves soil quality and fertility. During aerobic composting, heat is generated from the metabolic activity of thermophilic microorganisms and may contribute to inactivation of contaminant pathogens. Consequently, to accelerate inactivation of several resident fecal pathogens (i.e. *Escherichia coli* O157:H7 and *Salmonella* spp.), aerobic composting is a recommended treatment for animal manure, a major waste product in the U.S. Unfortunately, improperly composted manures have been implicated in the contamination of produce in the field and in the outbreaks associated with consumption of that produce. To ensure inactivation of pathogens at the surface of static compost piles, it is recommended that compost be turned periodically during the first weeks of composting. This safeguard practice, however, is not often implemented in situations where labor and resources are limited. Alternative management strategies are therefore needed to ensure the inactivation of pathogens on the surface of static piles. This project will focus on the relative contribution of non-thermal factors (pH, ammonia, organic acids, light, and moisture) to pathogen inactivation. To achieve these objectives, inactivation of pathogens (*E. coli* O157:H7 and *Salmonella* spp.) will be monitored in response to manure type, carbon feedstock, carbon:nitrogen ratio, and moisture using compost bioreactors, compost trays housed in environmental chambers, and static compost piles in the field. Data collected will assist in the development of expanded guidelines for compost operations where manure is used as an ingredient.

1	HIGH	1930	Kalmia Nniel-Tolbert	University of Delaware	Survival and transmission of pathogenic viruses in an agricultural environment	Seed, New
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INVESTIGATOR: Kniel-Tolbert, K.

PERFORMING INSTITUTION:
ANIMAL AND FOOD SCIENCES
UNIVERSITY OF DELAWARE
NEWARK, DELAWARE 19717

SURVIVAL AND TRANSMISSION OF PATHOGENIC VIRUSES IN AN AGRICULTURAL ENVIRONMENT

NON-TECHNICAL SUMMARY: Contamination of ground waters and food supplies by pathogenic microorganisms is common in many areas of the United States and public health concerns are increasingly focused on **viruses**. This project examines the survival of **viruses** in specific agricultural applications including pesticides and fertilizers and biofilms.

OBJECTIVES: The proposed study has 3 objectives that focus on crucial areas of preharvest food safety where data is lacking. The first is to determine the sensitivity of human pathogenic **viruses** to commonly used pesticides and fertilizers. The second is to determine the survival of human pathogenic **viruses** in bacterial biofilms that could occur in an agricultural environment. Lastly, the information gained from objectives 1 and 2 will be used to identify potential reservoirs, routes of transmission, and develop methods to reduce transmission of these agents to agricultural crops.

APPROACH: **Viruses** vary greatly in their surface properties and survival characteristics. The selection of **viruses** for this project was based on several criteria: (1) their potential to cause serious diseases in humans, (2) limited information available on their environmental fate, and (3) implication in food- and water-borne outbreaks. Norovirus and hepatitis A **virus** (HAV) are the two most widely reported food- and water-borne **viruses**. HAV and other enteric **viruses** are primarily transmitted through fecal contamination and common-source epidemics from contaminated foods and water are well-documented. Norovirus has a high prevalence as an environmental contaminant as shown during the hurricane Katrina aftermath in Louisiana and Houston, where a large number of evacuees contracted gastroenteritis associated with Norovirus. Aichi **virus** is an infectious **virus** associated with consumption of contaminated oysters in Asia, Europe, and South America. It may be possible that Aichi **virus** has caused disease in North America as well, but was not detected. Symptoms are similar to Norovirus, and young healthy people are most infected. Specifically the four **viruses** selected are representative of two **virus** families (2 from each family as family members do not necessarily act alike). Studies will include two picornaviruses (hepatitis A **virus** and Aichi **virus**) and two important caliciviruses as Norovirus surrogates (the most closely related murine Norovirus and the traditional surrogate feline calicivirus). Norovirus cannot be laboratory cultured and the comparison of the murine Norovirus and feline calicivirus is an important aspect of this work, as to date only one date has studied them simultaneously. **Viruses** will be propagated and analyzed in mammalian cell culture. At least 5 different broad spectrum pesticides will be evaluated. Fertilizers high in either nitrogen or phosphorous will also be evaluated. A point will be made to evaluate those chemicals which have previously been tested on pathogenic bacteria for which there was differential survival, and in order to have the complete spectrum of information. **Virus** survival will be monitored in liquid preparations and in land applications. In a related project, **virus** survival will be monitored in bacterial biofilms. Biofilms of *Escherichia coli* O157:H7 and *Pseudomonas aeruginosa* will be grown on stainless steel and plastic coupons and spinach leaves. Bacterial cultures will be grow for 24 hours at 4C in 50ml centrifuge tubes on coupons and plant materials as previously described. The experimental goal is to determine how and if **viruses** are

incorporated into a growing bacterial biofilm. **Viruses** will be added at different time points (0, 24, 48, 96, 168 hr) and **virus** survival will be tested periodically as described above (every 3-6 days). Biofilms will be scraped from their support surface, bacterial cells pelleted, and **viruses** analyzed by PCR (for presence) and cell culture (for infectivity) as described above.

PROJECT CONTACT:

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ACCESSION NO: 0210874

PROJ NO: CALR-2007-02029 **AGENCY:** CSREES CALR

PROJ TYPE: NRI COMPETITIVE GRANT **PROJ STATUS:** NEW

CONTRACT/GRANT/AGREEMENT NO: 2007-35212-18239 **PROPOSAL NO:** 2007-02029

START: 01 SEP 2007 **TERM:** 31 AUG 2010 **GRANT YR:** 2007

INVESTIGATOR: Mandrell, R. E.

PERFORMING INSTITUTION:

USDA-ARS-WRRC

800 BUCHANAN STREET

ALBANY, CALIFORNIA 94710

ECOLOGY AND EPIDEMIOLOGY OF ESCHERICHIA COLI O157:H7 IN FRESH PRODUCE PRODUCTION REGIONS OF THE CENTRAL CALIFORNIA COAST

NON-TECHNICAL SUMMARY: Consumption of fresh fruits and vegetables is growing in the United States, but has coincided with produce-associated outbreaks. Our hypothesis is that key biotic and abiotic processes link the primary environmental reservoirs. Preventing on-farm contamination of produce with enteric pathogens would enhance the safety of the Nation's food supply. We propose to sample vertebrate animals, water, soil and produce, for EcO157, and commensal and non-O157 shigatoxin+ E. coli, and use epidemiological approaches to determine if: (1) vertebrate populations are sources of EcO157 contamination of watersheds, soil, and plants; (2) climate, landscape, irrigation, or management practices correlate with contamination; and (3) in-field contamination of leafy vegetables is associated with production practices and environmental risk factors. This information will be used to inform growers about strategies to prevent contamination, to educate the livestock community about potential impacts of their operations, minimizing wild animal contact with fields.

OBJECTIVES: We hypothesize that key biotic and abiotic processes link primary environmental reservoirs of E. coli O157 with fields of LVs located in the largest U.S. producing region for leafy vegetables (LV). The specific hypotheses and research objectives of the proposed research are that vertebrate populations (e.g., cattle and wild pigs) located in the interior of the Central California Coast (CCAC) function as the key source of EcO157 contamination of LV either through direct fecal deposition in LV fields or indirectly via fecal contamination of adjoining watersheds draining into and alongside the fields used for LV production. We propose to quantify environmental loading by vertebrate sources (especially cattle and wild pigs) that may function as key sources of EcO157 contamination of LV directly through fecal deposits, or indirectly, via fecal contamination of watersheds, wells or soil in contact with LV row crop fields; to create a molecular subtyping database of EcO157 strains in the CCAC to characterize the genetic relatedness of environmental and outbreak-associated isolates; to determine if increased commensal E. coli concentration and presence of shigatoxin-producing E. coli strains are associated with fecal contamination and an increased risk of EcO157 contamination in LV production areas; and to develop and disseminate educational materials for growers of fresh produce regarding specific strategies to prevent pre-harvest microbial contamination; to educate the livestock community about microbial water quality, potential impacts on down-stream stakeholders, wildlife management strategies, and effective BMPs for improving water quality.

ACCESSION NO: 0208788

PROJ NO: CALR-2006-01240 **AGENCY:** CSREES CALR

PROJ TYPE: NRI COMPETITIVE GRANT **PROJ STATUS:** NEW

CONTRACT/GRANT/AGREEMENT NO: 2006-55212-16927 **PROPOSAL NO:** 2006-01240

START: 30 SEP 2006 **TERM:** 30 SEP 2010 **GRANT YR:** 2006

INVESTIGATOR: Mandrell, R. E.

PERFORMING INSTITUTION:

USDA-ARS-WRRC

800 BUCHANAN STREET

ALBANY, CALIFORNIA 94710

ECOLOGY AND EPIDEMIOLOGY OF ESCHERICHIA COLI O157:H7 IN FRESH PRODUCE PRODUCTION REGIONS OF SALINAS, CALIFORNIA

NON-TECHNICAL SUMMARY: Consumption of fresh fruits and vegetables is growing in the United States, however, this trend coincides with produce outbreaks. Since 1995, 16 outbreaks of *Escherichia coli* O157:H7 (EcO157) associated with fresh lettuce or spinach have occurred; 7 outbreaks were traced to the Salinas, California. Intensive investigation of 3 recent outbreaks implicated a single farm as a supplier of contaminated lettuce, indicating pre-harvest contamination. Our hypothesis is that key biotic and abiotic processes hydrologically link primary reservoirs of EcO157, resulting in bacterial contamination of produce. The goal is to develop and implement science-based strategies to prevent on-farm contamination of produce. We propose to sample extensively vertebrate animal feces, creek/ditch and irrigation water, soil and produce for commensal and EcO157, and use epidemiological approaches to determine if: (1) vertebrate populations are sources of EcO157 contamination of watersheds; (2) climate, landscape attributes, and irrigation management practices correlate with increased risk of contamination; and (3) in-field contamination of lettuce with EcO157 is associated with management production practices and environmental risk factors in the Salinas. The information obtained from this study will be used to inform produce growers about strategies to prevent pre-harvest microbial contamination, to educate the livestock community about potential impacts of rangeland runoff on watersheds and down-stream stakeholders, and to develop effective management practices for improving water quality.

OBJECTIVES: We hypothesize that vertebrate populations (especially cattle and wild birds) function as a key source of *E. coli* O157:H7 (EcO157) contamination of watersheds where lettuce and other leafy vegetables are grown; that climate, landscape attributes, and irrigation practices correlate with increased risks of EcO157 and commensal *E. coli* contamination; and in-field contamination of lettuce plants with EcO157 relates to combinations of production practices and environmental risk factors in the Salinas Valley. The major objectives of this proposal are to (1) quantify environmental loading by vertebrate sources, (2) characterize predisposing conditions for hydrological transport of EcO157 and *E. coli* to lettuce fields, (3) determine if concentrations of non-O157 *E. coli* predict an increased risk of contamination with EcO157 in water, (4) identify the in-field mechanism(s) of contamination of lettuce, (5) create a molecular subtyping database of EcO157 strains to characterize the genetic relatedness of environmental and outbreak-associated isolates and (6) develop and disseminate educational materials for growers of fresh produce and the livestock community about microbial water quality, potential impacts on down-stream stakeholders, and effective BMPs for improving water quality.