Food Safety

The Regents of the University of California, Davis, Center for Produce Safety  $280,483

Title: Evaluation of multiple disinfection methods to mitigate the risk of produce contamination by irrigation water

Abstract: The Center for Produce Safety (CPS) will partner with the University of Tennessee (UTN) to explore water used for frost protection and irrigation, one of the most likely points of pathogen contamination during fruit and vegetable production. Previous studies have focused on chemical rather than microbiological water-quality parameters. Consequently, a knowledge gap exists regarding surface water sanitary quality and the risks associated with the timing and method of application. In response to proposed standards for surface water quality, the adequacy of three in-line methods for disinfecting frost protection and irrigation water will be evaluated. An ultraviolet light module, a chlorine dioxide injection system, and a peroxyacetic acid injection system will be evaluated based on the reduction of indicator microorganisms \(E.\ coli\) and fecal coliforms and the presence or absence of pathogens (Shiga Toxigenic \(E.\ coli\) [STEC]) in a double-cropping system with strawberry and cantaloupe. Disinfection techniques will be compared to non-disinfected, pond water with cattle access and populations of all organisms of interest. Populations of microorganisms will be evaluated pre- and post-treatment. Plant tissue will be sampled during flower, early fruit, peak fruit, and late harvest to determine transfer rates of foodborne pathogens, yield and quality characteristics.

The Regents of the University of California, Davis, Center for Produce Safety  $130,185

Title: Assessing postharvest food safety risks and identifying mitigation strategies for foodborne pathogens in pistachios

Abstract: In the past decade, nuts and nut products have been established as potential sources of foodborne illness. Outbreaks associated with the consumption of raw almonds, in-shell hazelnuts, peanut butter, pine nuts, and walnuts have been documented in North America and Australia. Until recently very little was known about the ecology of foodborne pathogens in nut production and processing environments, impeding the development of targeted commodity-specific intervention programs. The proposed research builds on recent research at the University of California, Davis (UCD), pertaining to the survival of \(Salmonella\) in pistachios. Points during postharvest handling of pistachios where foodborne pathogens may be reduced, controlled or amplified will be identified. These data and industry expert opinion will be used to construct a pistachio risk model to estimate risks from harvest to storage. This model will allow the pistachio industry to develop harvest management strategies that reduce the potential for product contamination. Characterization of the heat resistance of foodborne pathogens in inoculated pistachios under dry and moist heat conditions will provide the scientific foundation for process validation in the pistachio industry.

The Regents of the University of California, Davis, Center for Produce Safety  $324,403

Title: Effect of physiochemical and biological parameters on survival, persistence and transmission of norovirus in water and on produce

Abstract: The Center for Produce Safety (CPS) will partner with the University of Florida (UFL) to explore noroviruses, a leading cause of diarrheal disease in the world. Many of the infections begin with the consumption of contaminated food and water. Currently, it is widely known this virus is present in the natural environment, but it is unknown what environmental factors are able to decrease norovirus survival in irrigation waters or on produce and therefore prevent disease. In order to address this multi-faceted problem, this project brings together experts in the fields of food safety, foodborne disease and noroviruses. The proposed studies will test several conditions associated with irrigation water quality on
their ability to impact norovirus survival in the water, on produce and transmission to a host. The identification of factors that reduce virus survival and/or disease will allow for the development of food and water intervention and treatment processes to reduce virus contamination and thus reduce the incidence of norovirus disease.

The Regents of the University of California, Davis, Center for Produce Safety

$162,681

Title: Remediation and recovery measures to expedite plant or replant of vegetables following soil contamination by *Salmonella enterica*

**Abstract:** Producers of fresh fruits and vegetables need practical and sustainable methods to minimize the survival of human pathogens, such as *Salmonella*, in production soil. Much of the research effort to date has focused on long intervals following manure application and process controls for composting and thermal pasteurization treatments during pelletizing. Despite best intent in setting composting standards, contaminated compost applied to production fields remains a significant problem. Contaminated soil has resulted in hundreds of acres of abandoned crop due to *Salmonella* in consecutive years, especially with lettuce and salad greens. Remediation and soil recovery treatments are needed to effectively shorten the time interval before replanting of such high value vegetables without fear of losing another crop to preventable sources of contamination. This research will focus on optimizing the existing knowledge in low-residue cover cropping, solarization, and field flooding for remediation of soils contaminated with chicken manure known to harbor *Salmonella*. The anticipated outcome is a set of grower options for integrated management of contaminated soil that may be extended to other pathogens and sources of contamination such as flooding, domestic animal grazing of crop residues, and large numbers of animal intrusion to croplands.

The Regents of the University of California, Davis, Center for Produce Safety

$274,693

Title: Food safety risks at the fresh produce-animal interface: Identifying pathogen sources and their movement on diversified farms

**Abstract:** The Center for Produce Safety (CPS) will partner with North Carolina State University (NCSU) to explore the direct application or indirect transfer of animal manure into the produce farm environment as a potential source of fresh produce contamination. One knowledge gap that exists is in ascertaining the specific metrics and consequences of proximity at the interface of agricultural production involving food animals and fresh produce. Without this information it is difficult to prescribe practical risk-reduction practices and expect producers to heed those measures. This is especially true on diversified farms where the integration of growing animals and fresh produce in close proximity predisposes the fresh produce to contamination by animal shed pathogens. This project will 1) Identify sources of *Salmonella*, STEC O157:H7 and non-O157:H7 STEC on diversified farms and determine the impact of buffer distance on their movement at the animal:produce interface; 2) Validate the outcome of the first objective by conducting a controlled study to determine source and movement of indicators and pathogens at the animal:produce interface on the Piedmont Agriculture Research Station. The study will result in identifying risk gaps and will help the fresh produce industry strategize control measures to prevent fresh produce contamination.
The Regents of the University of California, Davis, Center for Produce Safety $291,023

Title: Validation of geospatial algorithms to predict the prevalence and persistence of pathogens in produce fields to improve GAPs

Abstract: The Center for Produce Safety will partner with Cornell University (CU) to explore foodborne pathogen contamination of produce in the production environment. There is a need for further development of science-based approaches to assist growers in minimizing the risk of produce preharvest contamination. The purpose of this project is to validate a global information system (GIS) based modeling tool that identifies specific locations and times on a produce farm where the prevalence of foodborne pathogens is elevated and, as a result, the risk of produce contamination is higher. This GIS tool can be applied to any location because it utilizes a farm’s unique combination of landscape characteristics (e.g., proximity to domestic animal operations), soil properties (e.g., soil moisture), and climate (e.g., precipitation) in its prediction process. The implementation of GIS by the produce industry will increase the understanding of factors that promote foodborne pathogen prevalence and persistence on fields, and will assist growers in focusing their food safety efforts using risk-based strategies. Growers will be able to target areas within their farms that are at high risk for contamination and implement more informed field management decisions and science-based strategies (e.g., alteration of cropping schemes) to limit potential produce contamination.

The Regents of the University of California, Davis, Center for Produce Safety $150,745

Title: Evaluation of risk-based water quality sampling strategies for the fresh produce industry

Abstract: The Center for Produce Safety (CPS) will partner with the University of Arizona (UA) to develop a risk-based approach for sampling of irrigation waters used for produce production to minimize the risk of crop contamination by foodborne bacteria. Irrigation water has been implicated in a number of outbreaks associated with fresh produce. Currently there are no scientific methods for determining where and how often water quality sampling should take place in constructed irrigation systems typical of Southern California and Arizona. A risk assessment will be used to consider factors which are known to influence contamination of surface waters including rainfall, watershed characteristics (e.g., landscape features, urban development), the type of produce and the irrigation method (e.g., spray vs. flood) to develop recommendations for risk-based sampling strategies for growers. Additionally, since rainfall plays a significant role in surface water quality, a user-friendly application will be developed for use with mobile phones or other hardware to aid in determining the need for risk-based sampling based on downloadable local weather information. This study will offer recommendations towards risk-based sampling strategies (frequency, timing, location, volume) for *Escherichia coli* (*E. coli*) indicator bacteria in irrigation waters that provide the greatest risk reduction to produce.