

Project Summaries

Research Session Part 1

Wednesday, June 20, 2018 - 8:15 am – 9:30 am

Research Session - Packinghouse and processing plant sanitation and wash water control are critical areas of produce safety research. Moderator: Joan Rosen, JC Rosen Resources

These issues have been amplified in recent years owing to the implementation of FSMA and sporadic but ongoing recalls associated with *Listeria monocytogenes* (Lm) cross contamination. This session will focus on the latest research on Lm in fruit packinghouses and potential strategies for mitigating the risks.

Characterization and mitigation of bacteriological risks associated with packing fresh-market citrus. Linda Harris, University of California, Davis

Summary - After harvest, fresh oranges and lemons are sorted, washed and packed in packinghouses for further distribution and sale. Because green and blue molds result in significant losses of citrus fruit during storage and shipping, fungicides are often applied during packing. Recirculating drench applications are common because they significantly increase fungicide efficacy, but they also provide an opportunity for cross contamination or movement of microorganisms throughout the facility, which can be a food safety issue if not appropriately managed. The overall goal of this project is to provide data that the California fresh citrus packinghouse industry can use to support the controls that reduce or eliminate foodborne pathogen cross contamination where citrus fruits are comingled or where recirculating materials come into contact with the fruit. A laboratory component is included to determine, for the most common fungicides, minimum compatible sanitizer concentrations that are effective in eliminating *Salmonella* and *Listeria monocytogenes*. The laboratory data will be verified in a pilot-scale citrus packing facility, and the results of these studies will be used to prepare documents the industry can use to support the efficacy of their food safety practices.

Factors that influence the introduction, fate and mitigation of foodborne pathogens on mangoes throughout the production chain. Michelle Danyluk, University of Florida

Summary - Understanding the persistence and mitigation of foodborne pathogens on the surface of mangoes is essential to the establishment of Best Management Practices for the responsible handling, packing, distributing, and importing of mangoes, and is a fundamental management prerequisite to providing customers with safe mangoes. There is inadequate science-based data to establish management standards and criteria for mangoes to meet pending requirements of the Food Safety Modernization Act. The purpose of this research project is to evaluate the persistence of foodborne pathogens on the surfaces of whole and fresh-cut mangoes, assess potential mitigation strategies for control of pathogens on mango surfaces, and appraise the ability of *Salmonella* to infiltrate mangoes under standard packinghouse conditions and then to determine the fate of the internalized cells. The data resulting from the research will specifically address data gaps the National Mango Board currently faces, and will provide research-based metrics to validate mitigation strategies.

***Listeria monocytogenes* growth and survival on peaches and nectarines as influenced by stone fruit packinghouse operations, storage and transportation conditions.** Mary Anne Amalaradjou, University of Connecticut

Summary - The recent multi-state *Listeria monocytogenes* outbreak associated with stone fruit consumption highlights the potential for stone fruits to serve as a vehicle in *Listeria* transmission. Further, the outbreak

also demonstrates the pathogen's ability to persist and survive on stone fruits during handling, storage and transportation. While investigations on the persistence of *Listeria* have been performed on other produce, there is a general lack of knowledge on the behavior of pathogens associated with stone fruits. Additionally, each produce type has unique compositional and physical characteristics that require produce-specific management practices. Therefore, to develop stone fruit-specific risk reduction knowledge and preventive controls, this study will investigate the survival and growth of *Listeria* on peaches and nectarines under packinghouse environment, storage and transportation conditions. The study will be performed under conditions simulating stone fruit unloading and staging, waxing and fungicide application, and storage and transportation from the packing facility. It is expected that results from this study will provide quantifiable data on the effect of current practices on *Listeria* survival on stone fruits. Furthermore, identification of food safety risks associated with different steps within the packinghouse continuum will help develop comprehensive preventive controls for foodborne pathogens including *Listeria monocytogenes*.

10:00 am – 11:00 am – Part II.

Control of *Listeria monocytogenes* on apple through spray manifold-applied antimicrobial intervention. Meijun Zhu, Washington State University

Summary – *Listeria monocytogenes* is listed by the Food and Drug Administration as a 'pathogen of concern' and has been singled out on both ready-to-wash and ready-to-eat produce due to its nature as a true environmental species. The Pacific apple industry, led by Washington, suffered a significant loss of income following the *L. monocytogenes* outbreak traced back to a California packer. The final FDA Produce Rule and Preventive Controls Rule are challenging apple packers and handlers to develop specific efficacy data for their process controls. The apple industry has an immediate need to begin the process of science-based improvements in *Listeria* control during packing and subsequent storage. The overall goal of the project is to comparatively assess and validate critical operating parameters for registered, commercially practical, and legally allowed sanitizer(s) against *L. monocytogenes*, and to further seek to verify their efficacy on multiple apple packing lines. The project will develop information for apple producers about the practical efficacy of antimicrobial interventions under commercial packing conditions, resulting in tested and proven methods for spray bar intervention in fresh apples, which will fill critical gaps in the knowledge and will be crucial for addressing *L. monocytogenes* safety in fresh apples.

Evaluation of the efficacy of antimicrobial agents to prevent the transfer of *Listeria monocytogenes* from existing biofilms to produce or processing surfaces. Rolf Joerger, University of Delaware

Summary - *Listeria monocytogenes* (Lm) is a foodborne pathogenic bacterium that can cause serious illness and even death in susceptible individuals. Outbreaks involving this pathogen have been associated with fruits, sprouts and vegetable row crops. Like most other bacteria, Lm can form biofilms or become part of biofilms with other bacteria on produce surfaces and on surfaces in produce harvesting and processing environments. Once established in a biofilm, Lm has highly diminished susceptibility to antimicrobial agents and is difficult to eradicate. Cells surviving in such biofilms can detach and be carried to new surfaces where they can start the formation of a new biofilm or become part of an existing biofilm. It is therefore extremely important to prevent the transfer of cells from existing biofilms to previously uncontaminated surfaces on produce or processing equipment. The study will examine the efficacy of antimicrobial agents to inactivate Lm released from existing biofilms and prevent the formation of new Lm-containing biofilms on produce and equipment surfaces.

Resolving postharvest harborage sites of *Listeria* protects Zone 1 surfaces. Trevor Suslow, University of California, Davis

Summary - Fresh citrus is an important global commodity and a major specialty crop in California. The 2014–2015 California Agricultural Statistics Review placed the combined value of oranges, lemons, and tangerines at over \$2 billion, and all three fruits are among the Top 15 Specialty Crops by value. Fresh whole citrus has not experienced an incident of recall, illness, or outbreak, and CA citrus production practices and regions appear to significantly limit the environmental risk of preharvest contamination. However, recent serious incidents involving the bacterial pathogen *Listeria monocytogenes*, associated with CA apples, have prompted proactive measures to more carefully assess postharvest risks and develop validated interventions for citrus system-wide. In this project, confidentially enrolled handlers will participate in a detailed survey for indicator *Listeria* and *L. monocytogenes*. The major outcome will be the development of model Environmental Monitoring Program (EMP) and guidance in establishing an environmental-zone Master Sanitation Schedule linked to EMP-outcomes for California fresh citrus packinghouses. Other anticipated outcomes are expected to include a general overview and report card of the CA citrus packing environment, and the identification of potential sources of *Listeria* related to citrus growing regions and harvest/postharvest practices. Closing this knowledge gap will result in measurable improvements in reducing *L. monocytogenes* prevalence.