**APPENDIX D**

# SAES-422

# Project Number: S294

# Project Title: QUALITY AND SAFETY OF FRESH-CUT VEGETABLES AND FRUITS

# Period Covered: 10/01/2014 to 09/30/2015

**Date of This Report: 01/24/2016**

**Annual Meeting Date: 06/09/2015**

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**Minutes of the annual meeting:**

1. Welcome and Introduction (Chair: Susan Bach)
   1. Meeting called to order at 10:00AM. Welcome by the Chair, along with a roundtable introduction. McCormick Place Convention Center, Chicago, IL (United Fresh Convention)
   2. Officers:
      1. Past chair: Eva Almenar, MI
      2. Chair: Susan Bach, BC (absent)
      3. Vice chair Angela Shaw, IA
      4. Secretary: Jeff Brecht, FL (absent)
   3. Administrative Advisor: Reuben Moore, Mississippi State University
2. Approval of 2015 Meeting agenda
3. Approval of 2014 minutes
4. Report from the Administrative Advisor, Rueben Moore.
   1. Distributed review of the S294 application for the Southern Region Excellence in Multistate Research Award
   2. Discussion on how to write future applications to improve award chances
5. Station Reports.

Each station provided a brief summary of what they have accomplished, followed by discussion

1. New Business
   1. Discuss communication methods
      1. Agreement that email is best method and repeated emails are okay
      2. Continual communication throughout the year
   2. Discussion of improved collaboration with United Fresh via the Food Safety & TechnologyCouncil; to be followed up on at this year's FSTC meeting.
      1. Follow up email will be sent in August to start the discussion.
      2. Goal is to have a list to UFPA by December 2015
   3. Improve attendance at S294 Meetings
      1. Discussion on web based method for those who cannot attend
   4. Election of new Secretary for 2015-17
      1. Jeff Brecht was elected
2. Adjourn. Meeting was adjourned at 12:30pm

**Accomplishments:**

The S294 group interacted with the United Fresh Food Safety & Technology Council (FSTC; <http://www.unitedfresh.org/food-safety/food-safety-technology-council/>). The FSTC is an about 125-member group made up of company decision-makers and R&D folks, including a few S294 members. We participated in their June 8 meeting by introducing the S294 institutions, participants, and research expertise areas in the morning, and having a session on identifying the industry’s research interests and priorities in the afternoon. There was interest expressed by FSTC in finding out what is known about the relationship between shelf-life of fresh-cut vegetables and fruits and growth of spoilage microorganisms and human pathogens (including effects of environmental and other factors like sanitizers, temperature and MAP). We agreed at our project meeting on June 9 to propose to United that we write a white paper on the topic that would be published by the association. We also agreed to reach out to the S1056 Multi-State project (Enhancing Microbial Food Safety by Risk Analysis) to partner with us. David Gombas from United is currently following up with the FSTC members to compile a more complete list of research interests for us and also gauging how much interest there is in the white paper idea.

**Objective 1. Evaluate methods of sampling and measuring flavor and nutrition of fresh-cut products to facilitate comparison to traditional shelf life**

Baldwin, Bai & Plotto (ARS-FL) Identification of strawberry varieties from breeding lines with enhanced flavor characteristics.

**Objective 2. Develop new strategies to improve and better maintain inherent fresh-cut product quality and nutrition.**

Barrett (CA) Studied the effects of cultivar and ripeness on fresh-cut mango instrumental and sensory qualities; calcium salts application on texture and sensory qualities.

Brecht, Huber & Sargent (FL) Infusion of fresh-cut strawberries with PME + calcium maintains 4-fold greater firmness during storage. Ackee arils stored at 5C versus 10C develop chilling injury-related tissue watersoaking. Pink tomatoes show reduced aroma volatiles at less than 15C; MA extends shelf life (slows ripening) at ≥15C, but also reduces aroma volatile production.

Baldwin, Bai & Plotto (ARS-FL) Edible coatings for zucchinis, destined as fresh-cut ready to eat or cooked product, extended shelf life, appearance, texture and flavor. Development of new clamshells with smaller openings that result in higher relative humidity, less weight loss and improved quality for small fruits.

Shaw (IA) Evaluation of produce sanitizers to improve shelf life and quality of melons.

Almenar (MI) Development of new bio-based materials for food packaging applications. Evaluation of possibilities for food applications of laboratory developed and commercially available bio-based packaging materials. Found interactions between in-package gas compositions and sanitizers that affect safety and quality of fresh-cut produce. Development and validation of a new packaging systems made from natural resources for fresh produce.

Forney (NS) Market life of new red raspberry cultivars with superior postharvest quality can be further extended by atmosphere modification. Forney & Fan (NS) Improved process were developed for value-added fruit and vegetable products.

**Objective 3. Improve understanding of physiological mechanisms that affect fresh-cut product quality.**

Huber and Sargent (FL) Characterized programmed cell death (PCD) in ethylene-treated cucumber fruit and showed that increases of PCD-related proteases and nucleases precede loss of cell integrity and watersoaking.

Baldwin, Bai & Plotto (ARS-FL) Use of pre-chilling heat treatments on green tomatoes to reduce chilling-induce flavor loss.

**Objective 4. Determine critical factors in controlled inoculation studies with human pathogens and surrogates that influence the outcome of quantitative microbial risk assessments.**

Danyluk (FL) Advanced ripeness and bruising do not generally increase the risk from E. coli O157:117 and Salmonella for properly handled strawberries and blueberries.

Erickson (GA) Studying the surface contamination and internalization of pathogens in leafy greens due to fertilizing with manure or other types of compost can improve practices followed by organic growers.

Shaw (IA) Evaluation of produce sanitizers to determine most effective against E.coli O157:H7, non-O157 STEC, Salmonella, and Listeria monocytogenes. Ability of grape seed extract to control Listeria monocytogenes in wheatgrass juice.

Nannapaneni (MS) Acid stress adaptation when induced at 37°C in Listeria monocytogenes is stable at 4°C for 24 h and at 37°C or 22°C for 2 h. Immediately upon induction, acid stress adaptation also induced cross protection in Listeria monocytogenes against lauric arginate inactivation. Acid adaptation induced cross protection against lauric arginate is reversible within 1 h at 4°C.

**Objective 5. Evaluate and control unintentional and intentional microbial contamination of intact and fresh-cut produce.**

Wright & Koo (AR) Application of antimicrobial wash to control Listeria monocytogenes, Salmonella typhimurium, and Escherichia coli O157:H7 on fresh cantaloupe.

Bach & Delaquis (BC) Increased knowledge pertaining to the survival of Salmonella enterica in mixed ingredient salads. Increased knowledge pertaining to the effects of stress on the survival of VTEC on fresh-cut lettuce

Schneider (FL) A square root model was developed for growth of Listeria monocytogenes on fresh-cut cantaloupe, honeydew and watermelon, which can be used in subsequent quantitative microbial risk assessments.

Mendonca (IA) Electron beam radiation resistance and injury in starved Escherichia coli O157:H7.

Doyle et al. (GA) Increased risk-based environmental and product testing by the food industry, and the proper diagnosis and reporting of cases by medical clinicians, can reduce foodborne outbreaks.

Fan (NS) Isolated and identified heat-resistant fungi from frozen blueberry and improved heat treatment strategies were determined. Provided useful information on preventing losses due to spoilage caused by the heat-resistant fungi.

**Short-term Outcomes:** Project participants developed multiple guidance and training tools for growers, fresh-cut processors, and retailers.

Research topics identified through interaction with the United Fresh FSTC were:

* Quality: sensory attributes and shelf life; nutritional value of our products (methodology); library of conditions (growing conditions) that cause sensory attributes (color, density, leaf structure, flavor; survey development) (leafy greens)
* Consumer behavior
* Safety: direct product contact; irrigation water in Mexico (90,000 E.coli coliform); flood irrigation: mitigating steps work (pruning 24 inch up; wire; chlorinate without a huge irrigation system; q pipe that can blend); blackberries; raspberries; cane berry (pathogen reduction on the product)
* Repack and storage environment; water and mold is introduced (best practices for sanitation and micro); don’t wash items (prevalence study)
* Conventional flume [increase free chlorine related to safe harbor; how does that affect nutrition, sensory attributes (texture, color flavor) with fresh cuts]; secondary effects of chlorine levels
* Validate ongoing measurements within field to fork (preventive controls)/ separate chain

**Outputs:**

**Publications.**

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**Activities:**

**Conference.** Cantwell (CA) Annual Fresh-cut workshop at UC Davis in 2014 provided excellent outreach to the industry. Cantwell (CA) Organizing International Fresh-cut Produce Research Conference in 2015

**Training program:** Shaw (IA) On-line food safety education for school gardens and university farms (<http://www.safeproduce.cals.iastate.edu/elementary/>).

**Milestones:** Collaborations were established between participating institutions (CA, FL, ARS-FL; MI, MS) for research on new pre-cutting and post-cutting treatments including packaging to better maintain fresh-cut product quality. The United Fresh Food Safety & Technology Council was consulted to identify industry research priorities for development of the next (2016-21) project.

**Impacts:** Availability of best-practice guidance and standardized methods for food safety risk assessments of fresh-cut product treatments that reduce the likelihood of food safety events by replacing ineffective food safety practices with science-based procedures. Participants using standard protocols for quantifying flavor-based shelf life and microbiological risk assessment.