Produce Research: A Fresh Cut Processors Perspective

<u>Who am I?</u>

- Micah Fuson (Mike-ah; Few-son)
- Worked in produce growing, harvesting, and processing for 20 years
 - Sure-Fresh Produce
 - Apio/Curation Foods
 - Boskovich Farms/Fresh Prep
- Quality/Food Safety Positions at each Company



Why am I here?

- Member of the United Fresh Food Safety Council (IFPA International Fresh Produce Association)
- Numerous Research Projects within private companies to make improvements in products and investing time into testing Company Culture
- Perspective
 - Produce Processors
 - Careers Shaped by Incidents
- My focus for the last 5 years: Mentoring/Counseling on Work Culture and Food Safety Culture.

Apio/Curation Foods CFIA Event:

- CFIA Random Scheduled Testing of Listeria
- Packaged Salad Tested positive for Listeria Mono
 - Low level L. Mono enumeration
- Isolated Salad to Canada only
- No illnesses or Outbreak event
- Numerous Sampling events conducted over months (>500 samplings taken)
 - Each Sampling event found L. Mono
- No Findings onsite (300+ swabs, and FDA 1 week investigation/Swabathon/subsequent internal swabathons)

Apio/Curation Foods CFIA Event:

- CFIA agencies were helpful to continue enumeration, initially
- Food Safety Risk?
 - Low level enumeration was questioned
 - Removal of enumeration process
 - Positive/Negative only to complete event
 - CFIA Risk Assessment justification (sampling location)
 - Recalls Required during event
 - Similar levels in dirt from fields/No kill step
 - Informal discussion with FDA/CF-SAN on Risk of low level –enumeration

Apio/Curation Foods CFIA Event:

- Standard for different food types
 - Allowance of L. Mono in defined products (RTE 1, 2A, 2B)
 - RTE 1 Can grow supporting Foods Listeria allowance
 - Product tested and proven RTE 2A limited <100 CFU/g vs RTE 2B no growth over shelf life
- CFIA Testing Protocol for Allowance of low-level Listeria
 - Seek approval for RTE 2A or 2B status
- How to conduct this testing without direct risk to recall products within the USA
 - Heavy separation of Production Runs
 - Take the risk
 - Growth potential assessment via inoculation, outside lab research.

Next Steps from CFIA Event:

- California Poly Technic State University (Cal Poly) San Luis Obispo Connection
- Dr. Lathrop project for Listeria in non traditional salad ingredients approved with CPS.
- CFIA event salads were non-traditional ingredients
- Apio/Curation Foods Utilize to meet CFIA Listeria Testing requirement
 - Goal to move Apio non-traditional salad products to RTE 2 A (<100 CFU/g level of L. Mono) with CFIA.



The effects of storage conditions and the microbiome of nontraditional salad ingredients on the fate of listeria monocytogenes

Industry Need

- A variety of new salad blends have been developed from non-traditional ingredients
- These ingredients have not normally been consumed raw or may not have even been widely consumed
- Because of this change in the way these products are consumed the potential risk associated with foodborne pathogens such as *Listeria monocytogenes* should be reassessed



Research Purpose/Objectives

- Determine if *L. monocytogenes* will grow, survive or die-off in fresh-cut broccoli stalk, Brussels sprouts, kale and beet greens under ideal, abusive and "realworld" storage conditions: 4, 12, 22 and 35°C
- Determine if *L. innocua* can be used as a surrogate in the subsequent simulated storage and distribution tests
- Determine how simulated storage and distribution conditions (physical and temperature abuse) influence *L. innocua* on the selected products





Methods - Challenge Study

- Shredded broccoli stalk, sliced Brussels Sprouts, chopped kale and chopped beet greens obtained from a processor
- Product bulk inoculated at the targeted level of 2-3 log CFU/g with a 5-strain cocktail of *L. monocytogenes* or *L. innocua*
- Inoculated product was weighted into polyethylene bags (50-200g) and sealed
- Samples were incubated and sampled at:
 - 4°C: 0, 5, 10, 17, and 25 days
 - 12°C: 0, 12 h and 1, 3, 5, and 7 days
 - 22°C: 0, 4, 8, 16, 24, and 48 h
 - 35°C: 0, 2, 4, 8, and 12 h



Methods – Simulated Storage and Distribution

- Broccoli stalk, Brussels sprouts, kale and beet greens were obtained from our collaborator in 12 oz bags packed in commercial transport cases
- Bags were individually inoculated with *L. innocua* using a sterile needle and syringe at the target inoculum level 2-3 log CFU/g
- Testing done at Cal Poly's Packaging Dynamics
 - Conditioning, Drop, Compression, Vibration, Drop
- Abused and non-abused samples were incubated sampled at:
 - 4°C after inoculation, after conditioning, post-abuse,
 2, 6, 11, and 16 days
 - 8°C after inoculation, after conditioning, post-abuse,
 2, 4, 6, and 11 days





L. monocytogenes Challenge Study

Table 1. Time when significant (p < 0.05) growth of *L. monocytogenes* was observed on broccoli stalk, Brussels sprouts, kale and beet greens

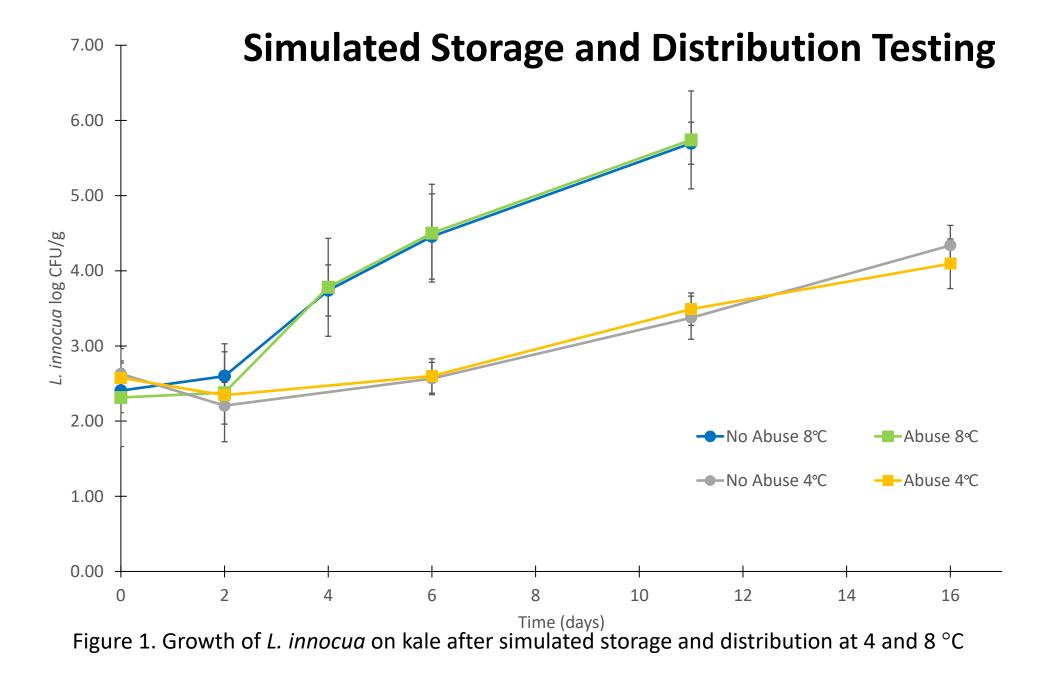
		Time (log CF	U/g increase)		
Temperature (°C)	Broccoli Stalk	Brussels Sprouts	Kale	Beet Greens	Traditional Salad Greens 5°C
4	10 d (0.9)	25 d (0.6)	17 d (1.2)	17 d (1.1)	14 d (~2.7)Iceberg ²
81	6 d (1.7)	6 (1.2)	4 d (1.4)	4 d (1.3)	16 d (~2.0)Spinach ³
12	3 d (2.6)	3 d (1.1)	3 d (1.8)	3 d (1.6)	10 d (~1.0)Romaine ⁴
Est. Shelf Life	17 d	17 d	20 d	15-17 d	

¹ L. innocua data from storage and distribution study

² Carrasco et al. 2008

³ Omac et al. 2015

⁴ Oliveira et al. 2010



Key Outcomes

- Growth of L. monocytogenes occurs in non-traditional salad ingredients, although at lower rates than traditional ingredients, similar growth to romaine. If loss of temperature control occurs this data can be used to help assess the potential for increased risk of *L. monocytogenes* growth
- L. innocua can be used as a surrogate for L. monocytogenes in broccoli stalk, Brussels sprouts, kale and beet greens
- Physical abuse during storage and distribution did not increase the risk of L. innocua growth

What's Next?

- Mixed Salad blends
 - Testing was ongoing for these items 2021/2022
 - Challenges with Covid/Company
 - Submitted to CFIA/Health Canada Rejected due to similar growth rates as romaine. Insufficient data to change category. Will review with CFIA on risks with testing for listeria.



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- Undergraduate Students Rebecca Bland, Kyle Nguyen, Miranda Ellis, Chris Lu, Chloe McGovern, Ian Jennings, Taran Virdi, Stephanie Goryl,



Produce Research – How it gets done!

Published Works

- Scientific Journals
- Advocacy Groups
- Universities
- Government Agencies
 - USDA
 - FDA

Produce Research – How it gets done!

- Produce Company Research (Private)
 - All Processors conduct research at some level
 - Most Companies have limited research capabilities
- Center for Produce Safety (CPS)
 - Collective to Generate Research for Produce

Produce Research – Value attributes

Assessment of Values with Multiple Produce Processors (12)

- Access
 - Can you get it
 - Hurdles to get to it
- Applicable
 - General Research
 - Specific to a Product
- Connection to Produce/Industry
 - Directed Results to Produce Industry
 - Feedback loop with Produce
- Current/Timely
 - Regularly Occurring?
 - Keeps up with Produce Events

Produce Research Value Assessment

	Access	Applicable Information	Connection to Industry	Current/Timely	Score
Scientific Journals	High	Medium	Low	Low	7
Advocacy Groups	Low	High	High	Medium	9
Universities	High	Medium	Low	Low	7
Government Agencies	Medium	Low	Low	Low	5
Produce Companies	Low	High	High	High	10
Center for Produce Safety (CPS)	High	Medium	High	High	11

High – 3 points, Medium – 2 points, Low – 1 point (12 companies contributed)

Produce Research – Assessment Results

Value to the Produce Processor Published Works

- Scientific Journals Medium
- Advocacy Groups Medium
- Universities Medium
- Government Agencies Low
- Private Company Research High
 - All Processor teams conduct research at this level
 - Majority of Companies have little to no input.
 - Sharing?
- Center for Produce Safety (CPS) High

Produce Research –

High Scoring Groups (CPS vs Private Companies)

Produce Company Value:

- (80% No R&D Funding / 20% Funding R&D)
- 20% Funding R&D only 10% of them are funding R&D for Food Safety
 - (approx. 2% of private companies driving food safety R&D)

Limitations of Private Companies:

- Sharing of Results
 - Competition/NDAs
 - Monetizing Results

CPS Advantages:

• Utilizing Private & Public funding to drive results for public usage

Center for Produce Safety



Mission: Fund the science, find solutions and fuel the change!

Purpose: Providing the science to support produce safety

Center for Produce Safety

The Process:

- Process developed and fine-tuned over time
- Gather input each year:
 - CPS stakeholders
 - Learnings from outbreaks
 - FDA and CDC
 - CPS technical committee
- Prepare Request for Proposal (RFP) and communicate to research community

The Process Continuted:

- Conduct sessions with research community to answer questions, offer resources to improve quality of subsequent research proposals (Universities/FDA/USDA, Private Industry Researchers)
- Preliminary proposals submitted and reviewed by technical committee
- Researchers with most promising proposals invited to submit full proposal for review
- Technical committee performs formal review and prioritizes projects for funding
- Prioritized list of projects presented to CPS Board for approval.
- Regular follow up with Researchers
- Annual review/publication of Produce Research completed.

Funding:

State Specialty Crop Block Funding:

- California Department of Agriculture
- Florida Department of Agriculture and Consumer Services
- Texas Department of Agriculture
- Washington State Department of Agriculture

Campaign Contributors from the Produce Industry:

CPS Support Base – Example of Growers



CPS Support Base – Examples of Processors















CPS Support Base – Examples of Customers



The Wegman Family Charitable Foundation









CPS Support Base – Examples of Advocacy Groups/Industry Groups





THE PRODUCE NEWS

















DVISORY BOAT

17 request for proposals (RFPs) published in 15 years

Total research investment (2008 to 2022) = \$40,589,334 funding 212 projects:

>Average number of projects per year = 14 (range 4 to 22 projects)

≻Average invested per year - \$2.7MM (range \$559K to \$3.8MM)

▶9 Rapid Response projects awarded opportunistically outside RFP process

48 institutions have received CPS awards

▶28 states, 5 countries

115 Principal Investigators (PIs) funded

➤36% have received 2+ awards

➢Nearly one-thousand post-docs, graduate and undergraduate students introduced to industry How Relevant is the Research?:

➢Overall Strong relevancy to industry needs due to Technical Committee being from within the industry, regulating, and overseeing industry

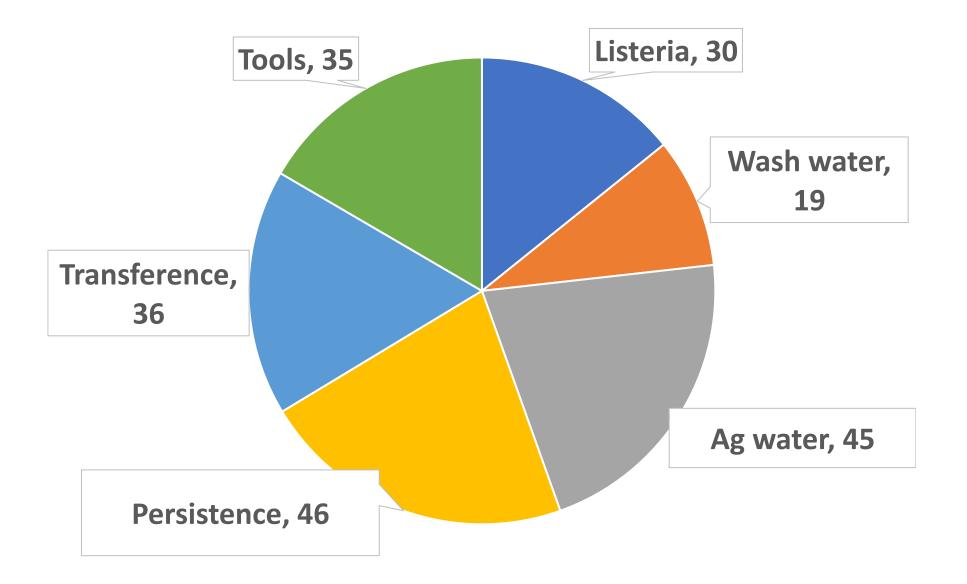
>Thousands of not relevant proposals have been left behind.

➢Some relevant, at the time, proposals did not give what was expected or enough industry value

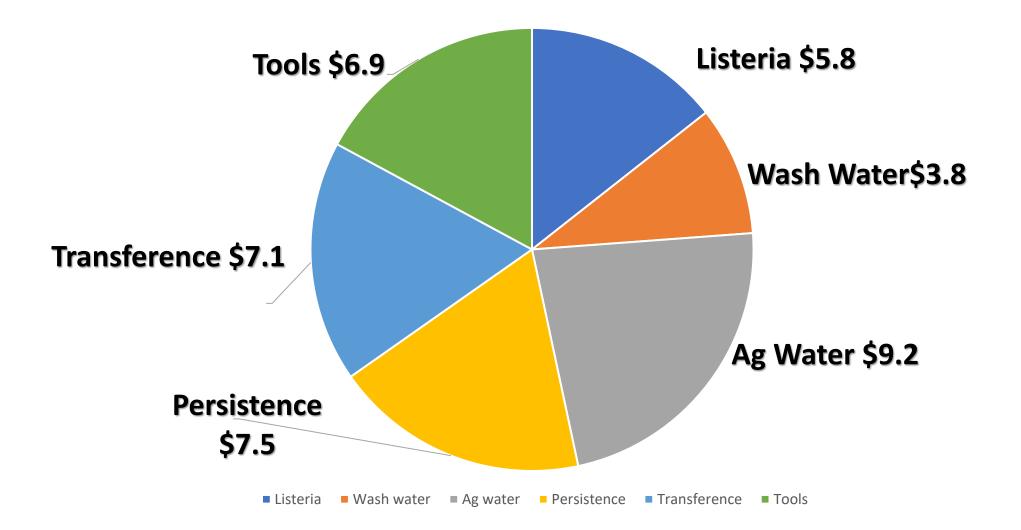
Example: Fly transport of pathogens from CAFOs to produce fields.

➢Well outside the already established produce distance guidelines already in place. Numerous smaller or niche growers may need the fly research project data but will not apply to 90%+ of growers.

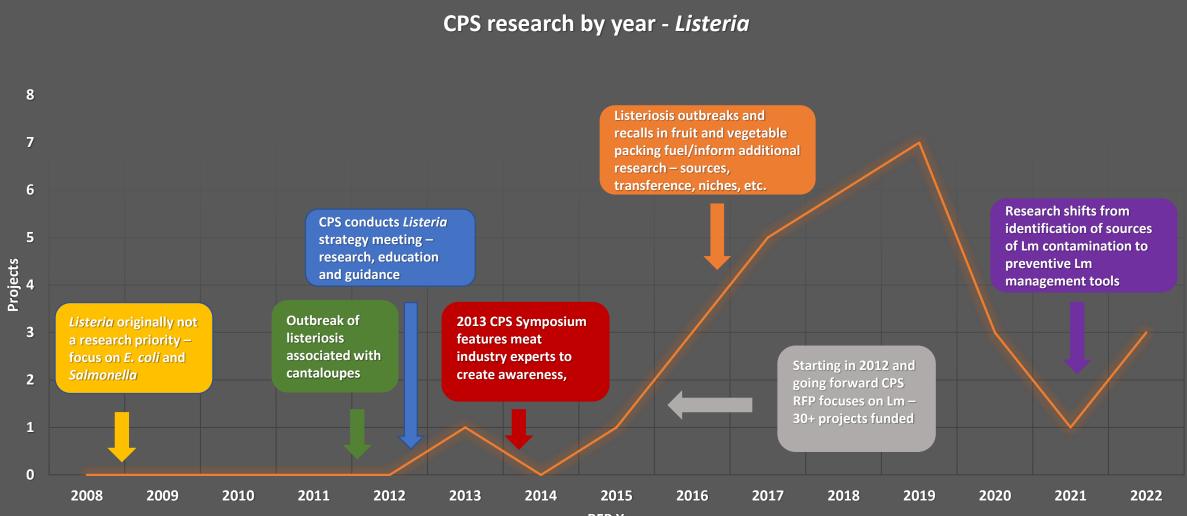
CPS Research by Category



CPS Investment by Research Category

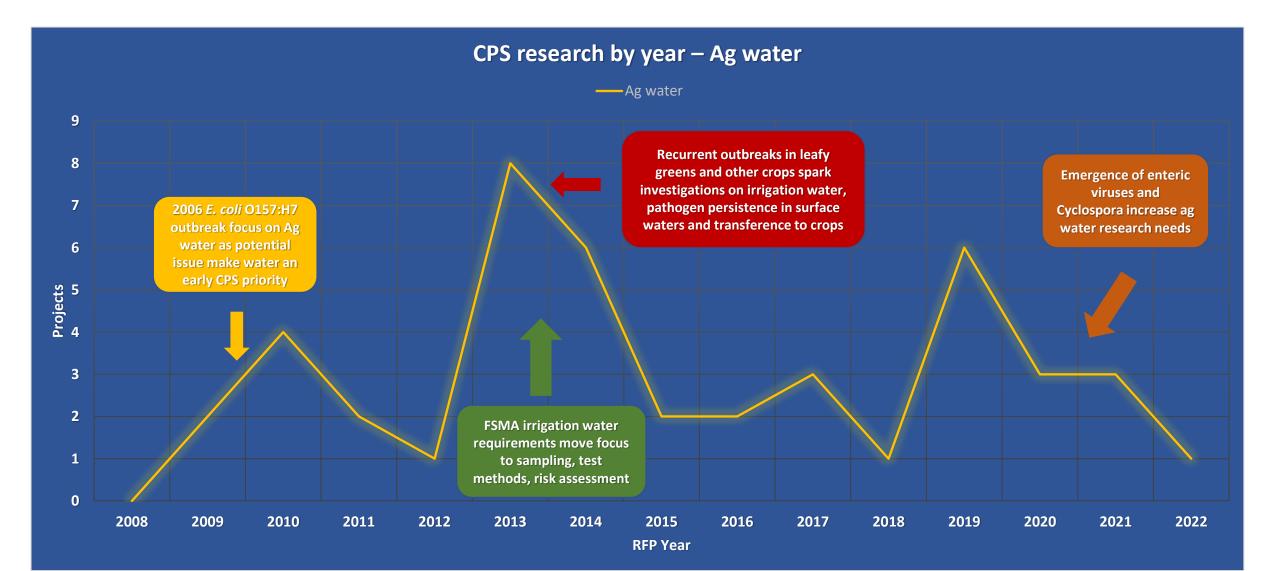


CPS research responds to industry challenges...



RFP Year

CPS research responds to industry challenges...



Produce Research – A Fresh Cut Processors Perspective

Next Steps

- Support of Public Access Research Groups
- Increase Access to Research Results (Food Safety)
- Get Involved



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Thank you!

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- Dr. Amanda Lathrop Cal Poly <u>Lathrop@calpoly.edu</u>