GROW WITH SCIENCE.

Leafy Greens Seasonality Webinar Part 1: What we know about seasonality issues and transition periods

September 16, 2020

Western Growers Science

WEBINAR LOGISTICS

- Everyone is muted.
- Questions will be addressed during the Q&A session at the end of the presentation.
- This presentation is being recorded.
- The recording/slides will be available to WG members only.
- Adjourn (60 minutes).
- There will be 3 important survey questions at the conclusion of this webinar. Your responses will be appreciated.

AGENDA

- Welcome and Introductions
- Background on seasonality and transition issues
- Overview of current research findings
- Status of ongoing research efforts and considerations for leafy green operations
- Data analytics and predictive analytics
- Q&A
- Closing Remarks

MEET THE SPEAKERS

Sonia Salas
AVP of Food Safety
Science and Technology, Western Growers

Marlene Hanken
Data Programs Analyst
Western Growers

Dr. Gregory Astill
Research Economist
USDA Economic Research Service

Dr. Trevor Suslow
VP of Food Safety
Produce Marketing Association

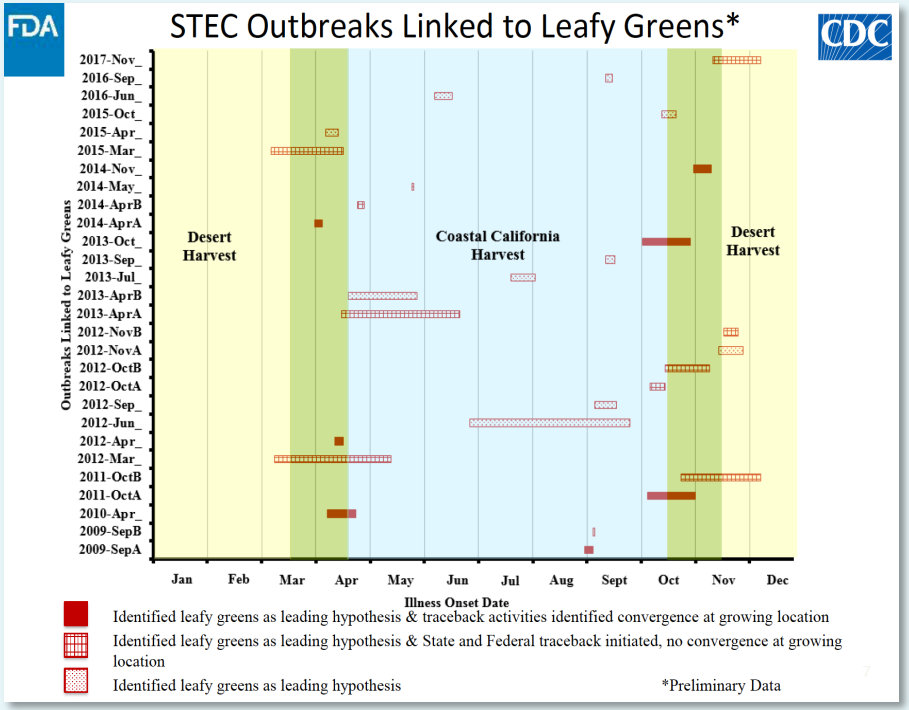
Background: What do we know about seasonality issues and transition periods?

Presented by Sonia Salas

BACKGROUND

When did the leafy green industry learned about seasonality issues?

In 2018, FDA/CDC reviewed and shared foodborne outbreak data (2009-2017) that suggested potential seasonality in outbreaks associated with leafy greens.



Source: Leafy Green Task Force 2018

BACKGROUND

- The summer of 2018 the Leafy Green Task Force was established
- Conclusions:
  - There is a pattern of outbreaks involving leafy greens and STEC
  - These outbreaks tend to occur during late season and transition periods
  - Romaine lettuce was involved in many, but not all of the outbreaks
- Recommendations:
  - Continue to assess data from past outbreaks
  - Document data on late season growing conditions and practices
  - Create training
  - Strengthen oversight during periods of concern

Leafy Greens Food Safety
TASK FORCE

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What do we know about seasonality issues and transition periods?

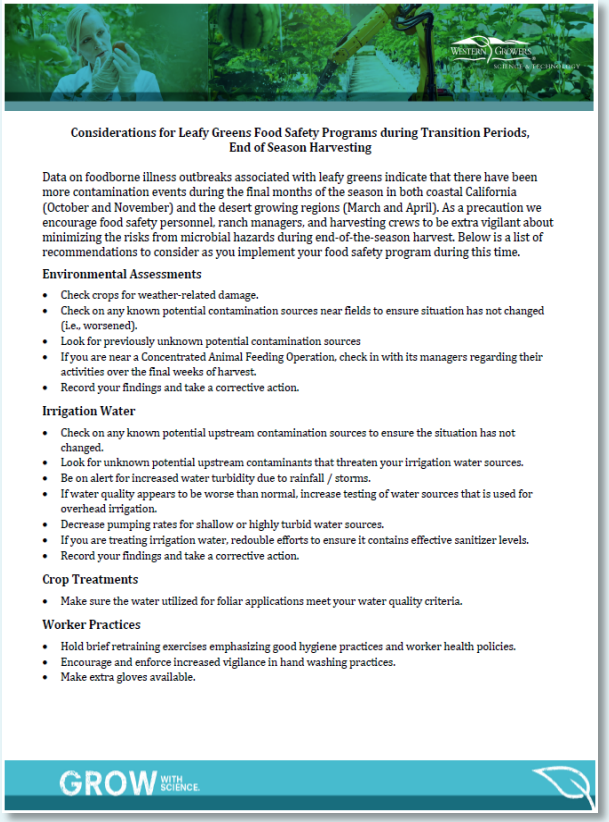
BACKGROUND

What is being done to address the recurring nature of STEC outbreaks and/or seasonality?

LGMA Response:

- In 2018, new practices addressing environmental weather conditions and CAFOs.
- In 2019, new practices related to water.
- Last month, more new practices related to water and field sanitation were approved.
- California LGMA is “HEAVYING UP” AUDITS throughout the seasonal transition.

WG’s Fact Sheet 2020: Considerations for Leafy Greens Food Safety Programs during Transition Periods, End of Season Harvesting.



Considerations for Leafy Greens Food Safety Programs during Transition Periods, End of Season Harvesting

Data on foodborne illness outbreaks associated with leafy greens indicate that there have been more contamination events during the final months of the season in both coastal California (October and November) and the desert growing regions (March and April). As a precaution we encourage food safety personnel, ranch managers, and harvesting crews to be extra vigilant about minimizing the risks from microbial hazards during end-of-the-season harvest. Below is a list of recommendations to consider as you implement your food safety program during this time.

Environmental Assessments

- Check crops for weather-related damage.
- Check on any known potential contamination sources near fields to ensure situation has not changed (i.e., worsened).
- Look for previously unknown potential contamination sources
- If you are near a Concentrated Animal Feeding Operation, check in with its managers regarding their activities over the final weeks of harvest.
- Record your findings and take a corrective action.

Irrigation Water

- Check on any known potential upstream contamination sources to ensure the situation has not changed.
- Look for unknown potential upstream contaminants that threaten your irrigation water sources.
- Be on alert for increased water turbidity due to rainfall / storms.
- If water quality appears to be worse than normal, increase testing of water sources that is used for overhead irrigation.
- Decrease pumping rates for shallow or highly turbid water sources.
- If you are treating irrigation water, redouble efforts to ensure it contains effective sanitizer levels.
- Record your findings and take a corrective action.

Crop Treatments

- Make sure the water utilized for foliar applications meet your water quality criteria.

Worker Practices

- Hold brief retraining exercises emphasizing good hygiene practices and worker health policies.
- Encourage and enforce increased vigilance in hand washing practices.
- Make extra gloves available.

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What do we know about seasonality issues and transition periods?

BACKGROUND

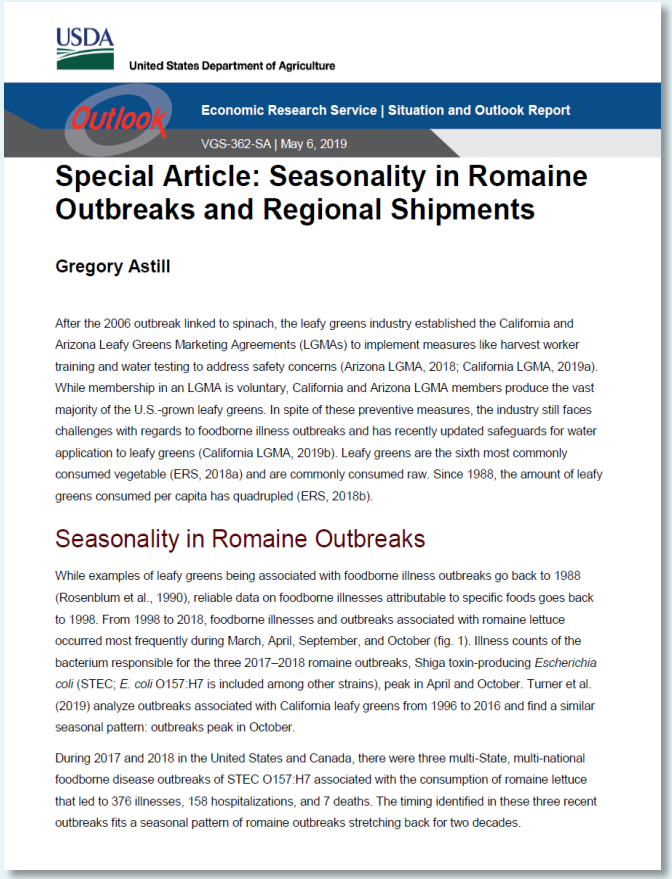
What other efforts have looked into STEC outbreaks and/or seasonality?

- In 2019, USDA ERS reviewed public data (2013 – 2018), including regional shipments that demonstrated seasonality in romaine lettuce outbreaks.

Currently,

- CPS Assembly on Seasonality of STEC Outbreak patterns.

- California and Arizona longitudinal research studies– but long-term intel.



USDA
United States Department of Agriculture

Outlook
Economic Research Service | Situation and Outlook Report
VGS-362-SA | May 6, 2019

Special Article: Seasonality in Romaine Outbreaks and Regional Shipments

Gregory Astill

After the 2006 outbreak linked to spinach, the leafy greens industry established the California and Arizona Leafy Greens Marketing Agreements (LGMAs) to implement measures like harvest worker training and water testing to address safety concerns (Arizona LGMA, 2018; California LGMA, 2019a). While membership in an LGMA is voluntary, California and Arizona LGMA members produce the vast majority of the U.S.-grown leafy greens. In spite of these preventive measures, the industry still faces challenges with regards to foodborne illness outbreaks and has recently updated safeguards for water application to leafy greens (California LGMA, 2019b). Leafy greens are the sixth most commonly consumed vegetable (ERS, 2018a) and are commonly consumed raw. Since 1988, the amount of leafy greens consumed per capita has quadrupled (ERS, 2018b).

Seasonality in Romaine Outbreaks

While examples of leafy greens being associated with foodborne illness outbreaks go back to 1988 (Rosenblum et al., 1990), reliable data on foodborne illnesses attributable to specific foods goes back to 1998. From 1998 to 2018, foodborne illnesses and outbreaks associated with romaine lettuce occurred most frequently during March, April, September, and October (fig. 1). Illness counts of the bacterium responsible for the three 2017–2018 romaine outbreaks, Shiga toxin-producing *Escherichia coli* (STEC; *E. coli* O157:H7 is included among other strains), peak in April and October. Turner et al. (2019) analyze outbreaks associated with California leafy greens from 1996 to 2016 and find a similar seasonal pattern: outbreaks peak in October.

During 2017 and 2018 in the United States and Canada, there were three multi-State, multi-national foodborne disease outbreaks of STEC O157:H7 associated with the consumption of romaine lettuce that led to 376 illnesses, 158 hospitalizations, and 7 deaths. The timing identified in these three recent outbreaks fits a seasonal pattern of romaine outbreaks stretching back for two decades.

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What do we know about seasonality issues and transition periods?

TO CONCLUDE…

- It is imperative to prevent leafy greens outbreaks before and during transition periods. Awareness and extra vigilance are key!

- Historical data as well as new research findings into the seasonality of STEC outbreaks can inform future leafy greens food safety practices

THANK YOU

Sonia Salas
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USDA Market Data Informs Romaine Lettuce Outbreaks

Dr. Gregory Astill
Research Economist
USDA Economic Research Service

United States Department of Agriculture

USDA Market Data Informs Romaine Lettuce Outbreaks

Gregory Astill, ERS-USDA

Sept. 16, 2020

The Findings and Conclusions in this Presentation Have Not Been Formally Disseminated by the U.S. Department of Agriculture and Should Not Be Construed to Represent Any Agency Determination or Policy.

This research was supported by the intramural research program of the U.S. Department of Agriculture, Economic Research Service.

What is the USDA Economic Research Service?

- Its mission is to anticipate trends and emerging issues in agriculture, food, the environment, and rural America and to conduct high-quality, objective economic research to inform and enhance public and private decision making.
- As a federal statistical agency, ERS shapes its research program and products to serve those who routinely make or influence public policy and program decisions.
- ERS research and analysis covers a broad range of economic and policy topics including the agricultural economy and food safety.
- ERS digitally publishes its research and analysis at www.ers.usda.gov.

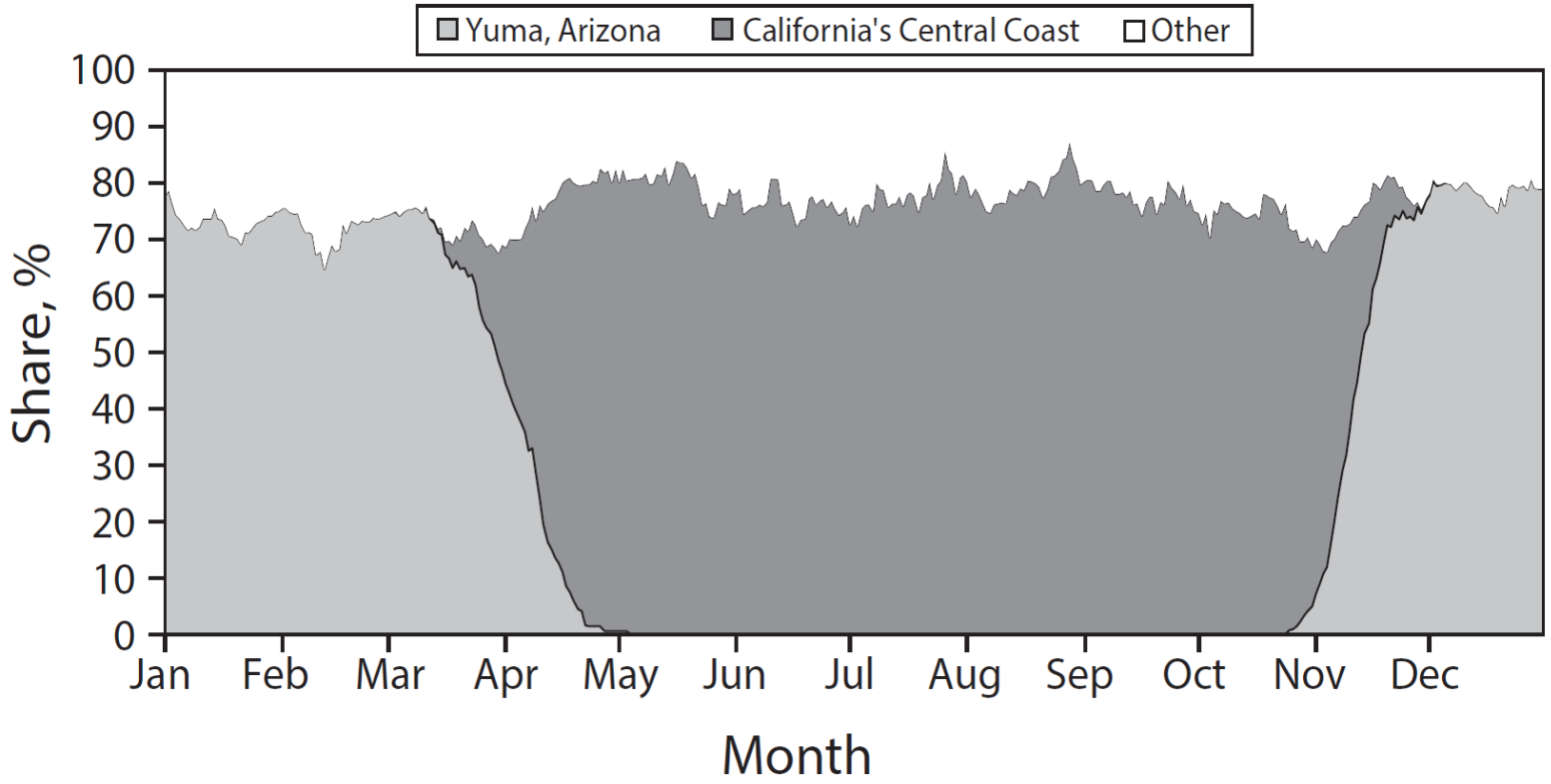
Key Findings

- USDA daily shipments data can inform outbreak investigations involving romaine lettuce.
- Both regional production and *E. coli* outbreaks appear to be seasonal.
- In the spring 2018 outbreak, almost no lettuce from Central California had been shipped on the date of first illness onset.
- In the fall 2018 outbreak, no romaine was shipped from Yuma, Arizona until 3 weeks after the date of first illness onset.
- Romaine shipments from Yuma, Arizona dropped and recovered in conjunction with U.S. Food and Drug Administration (FDA) advisories to avoid romaine lettuce during the fall 2018 outbreak.

Leafy greens background

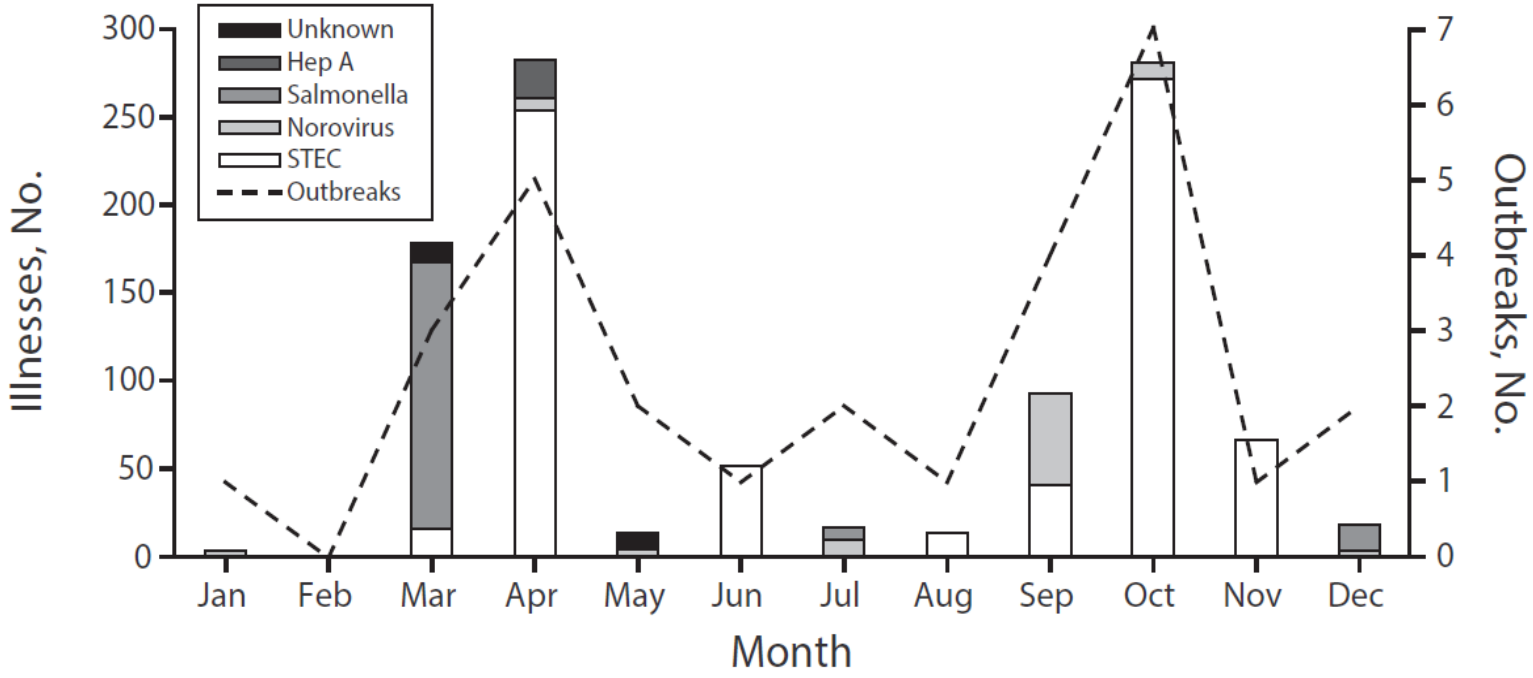
- Leafy greens are the fifth most commonly consumed vegetable, frequently raw so no chance for cooking to destroy pathogens.
- Leafy greens consumption per capita has quadrupled from 1988 to 2018.
- 40 outbreaks of Shiga-toxin producing *E. coli* (STEC) linked to leafy greens (including lettuce and spinach) from 2007 to 2017.

Romaine lettuce shipments in the U.S. are highly seasonal



Source: U.S. Department of Agriculture, Agricultural Marketing Service, 2013 - 2018.

Outbreaks associated with romaine lettuce are seasonal



Sources: National Outbreak Reporting System (NORS) 1998–2017 and Public Health Agency of Canada and Centers for Disease Control and Prevention outbreak reports 2017–2018 .

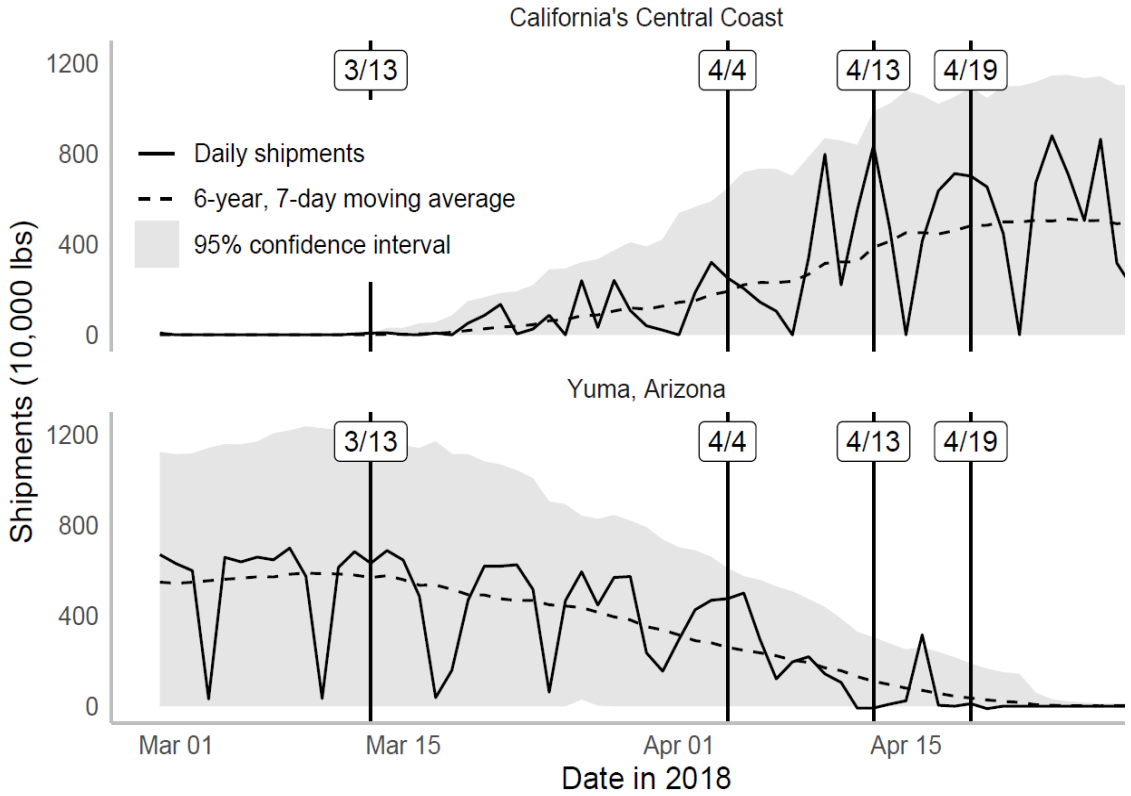
All recent outbreaks began during the tail end of the season

California's Central Coast	Yuma, Arizona	Date of First Illness	Number of Illnesses
Fall 2017		Nov. 5	25
	Spring 2018	Mar. 13	210
Fall 2018		Oct. 7	62
Fall 2019		Sept. 20	167

Challenges for FDA

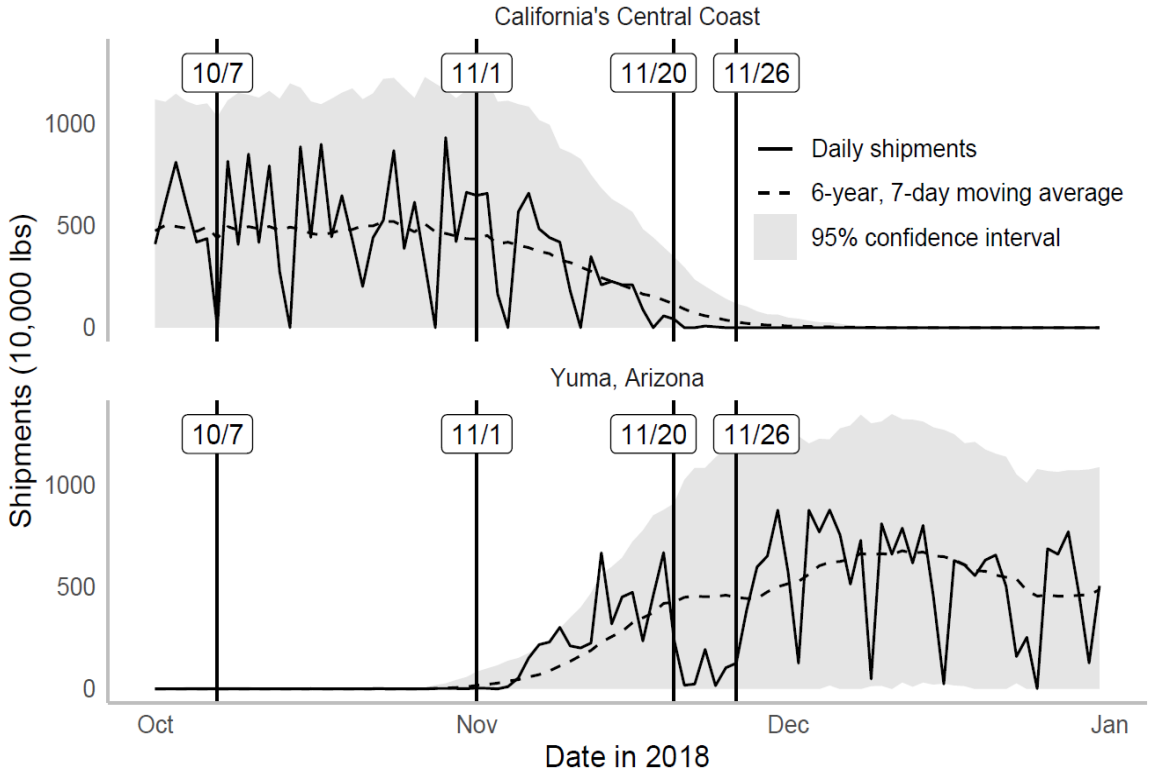
- Stopping a foodborne illness outbreak requires:
  - First, to recognize that an outbreak is happening, and
  - Second, to identify the food causing the outbreak
- Due to multiple factors, information is delayed
  - 2 – 3 weeks between a person first becoming ill and being connected to an outbreak
  - Then traceback begins with consumer interviews
- Balancing speed and reliability is important
  - Making the wrong call does not prevent illness and causes economic harm
  - 1996 strawberries case or 2008 tomatoes case

Spring 2018 Daily Shipments and Notable Outbreak Dates



Source. Authors' calculations using data from the Centers for Disease Control and Prevention, the Agricultural Marketing Service, and FDA.
Note. The first illness onset occurred on March 13. The FDA investigation began on April 4. On April 13, the FDA advised consumers to avoid chopped romaine from Yuma, Arizona. On April 19, the FDA advised consumers to avoid all romaine from Yuma. Six-year daily averages of shipments were calculated for each region over the period 2013–2018, from which the 7-day moving average was calculated as the mean of the period spanning 3 days before and 3 days after each date. The confidence interval was estimated via the standard deviation from the 6-year, 7-day moving average observed at that date over the 6 years of data.

Fall 2018 Daily Shipments and Notable Outbreak Dates



Source. Authors' calculations using data from the Centers for Disease Control and Prevention, the Agricultural Marketing Service, and FDA.
Note. The first illness onset occurred on October 7. The FDA investigation began on November 1. On November 20, the FDA advised consumers to avoid romaine. On November 26, the FDA advised consumers to avoid romaine from California's Central Coast. Six-year daily averages of shipments were calculated for each region
over the period 2013–2018, from which the 7-day moving average was calculated as the mean of the period spanning 3 days before and 3 days after each date. The confidence interval was estimated via the standard deviation from the 6-year, 7-day moving average observed at that date over the 6 years of data.

Conclusions

- Seasonality present in the 4 recent STEC outbreaks in romaine fits a 2-decade-long pattern
- A lag exists in public health information
  - From first illness onset:
    - About 30 days to begin FDA investigation
    - About 60 days to last illness onset
    - About 160 days to end of investigation
- Seasonal production allows ruling out regions
  - May to November onset can't be Yuma
  - December to April can't be Central California

Comment from epidemiologist Shannon E. Majowicz on seasonality and market data informing outbreak investigations

"On November 20, 2019, precisely one year after the November 20, 2018, FDA advisory to avoid romaine presented by Astill et al., the FDA and the US Centers for Disease Control and Prevention announced investigation of another outbreak of *E. coli* O157:H7, linked to romaine lettuce, likely from Salinas Valley. Although the November 20 date is undoubtedly coincidental, that another outbreak of this pathogen in this food product appears to be occurring at the end of the growing season underscores the need for continued and enhanced investment in foodborne disease prevention and control, including but not limited to multidisciplinary research studies and outbreak response capacity. ***Using market availability data as another tool in our outbreak investigation toolbox is warranted***, as is further assessment of the real-time utility of such data during outbreak investigations."

Hypotheses for Seasonal Contamination Risk

- Seasonality in domestic and wild animal movement
- Changes in farm management as production slows down may affect food safety activities
- Seasonal temperatures may affect both romaine production and bacterial growth
    - Maximum temperature in the 3 days preceding sampling has been found to be the most important variable in explaining *E. coli* contamination levels in leafy greens.

Sources

Astill, G., F. Kuchler, J.E. Todd, E.T. Page. 2020. "Shiga Toxin–Producing Escherichia coli (STEC) O157:H7 and Romaine Lettuce: Source Labeling, Prevention, and Business", *American Journal of Public Health*, Vol 110, No. 3, March.

Astill, G. 2019. "Special Article: Seasonality in Romaine Outbreaks and Regional Shipments", VGS-362-SA, Economic Research Service, May 6.

Astill, G., J.E. Todd, and E.T. Page. 2020. "Lettuce Help: USDA data on shipments of romaine lettuce can inform foodborne illness outbreak investigations and public health advisories", Amber Waves, Economic Research Service, February 3.

Overview of CPS STEC Seasonality Project

Dr. Trevor Suslow
VP of Food Safety
Produce Marketing Association

Brief Overview of CPS STEC Seasonality Project

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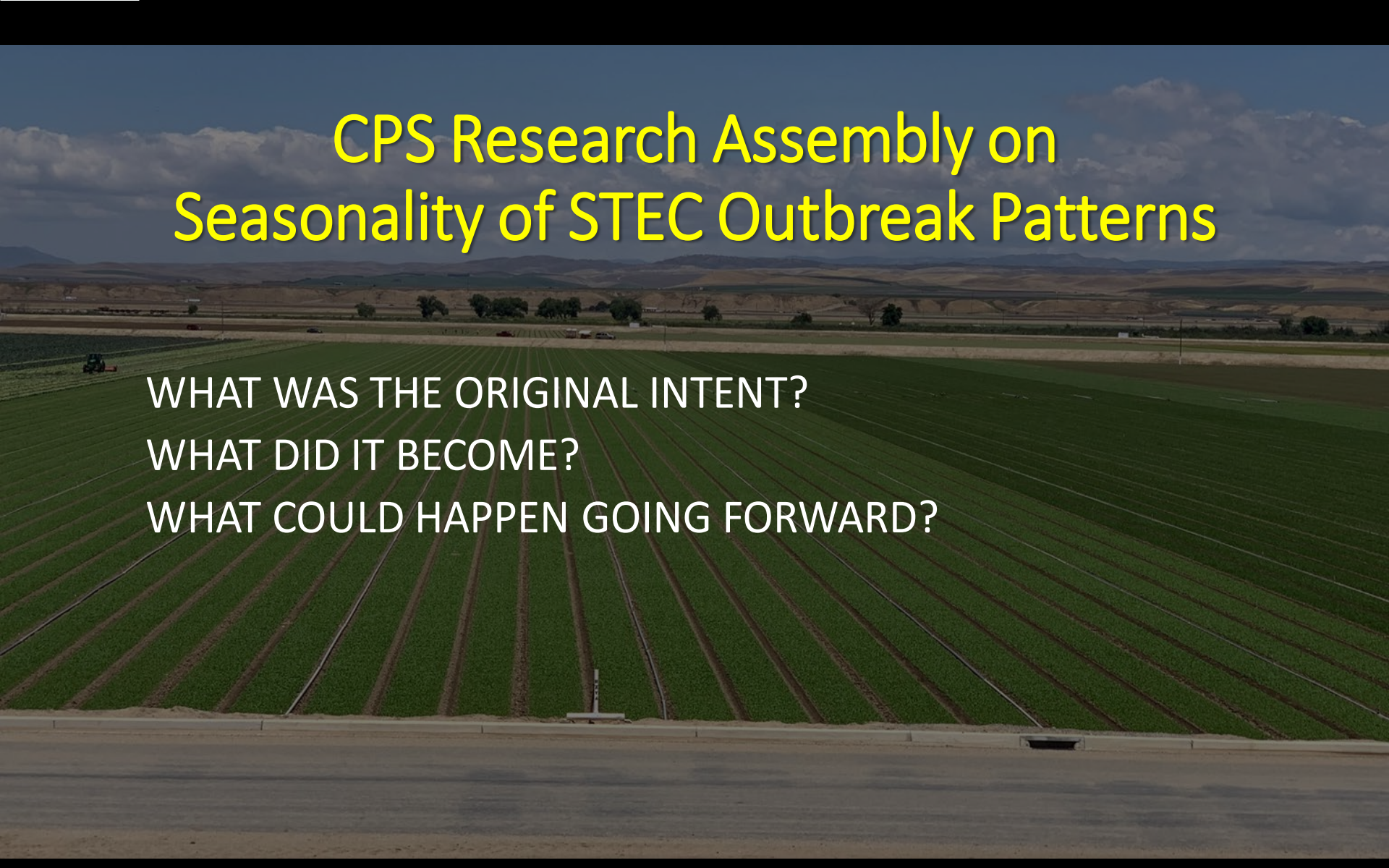


CPS Research Assembly on Seasonality of STEC Outbreak Patterns

WHAT WAS THE ORIGINAL INTENT?

WHAT DID IT BECOME?

WHAT COULD HAPPEN GOING FORWARD?

CPS Research Assembly on Seasonality of STEC Outbreak Patterns

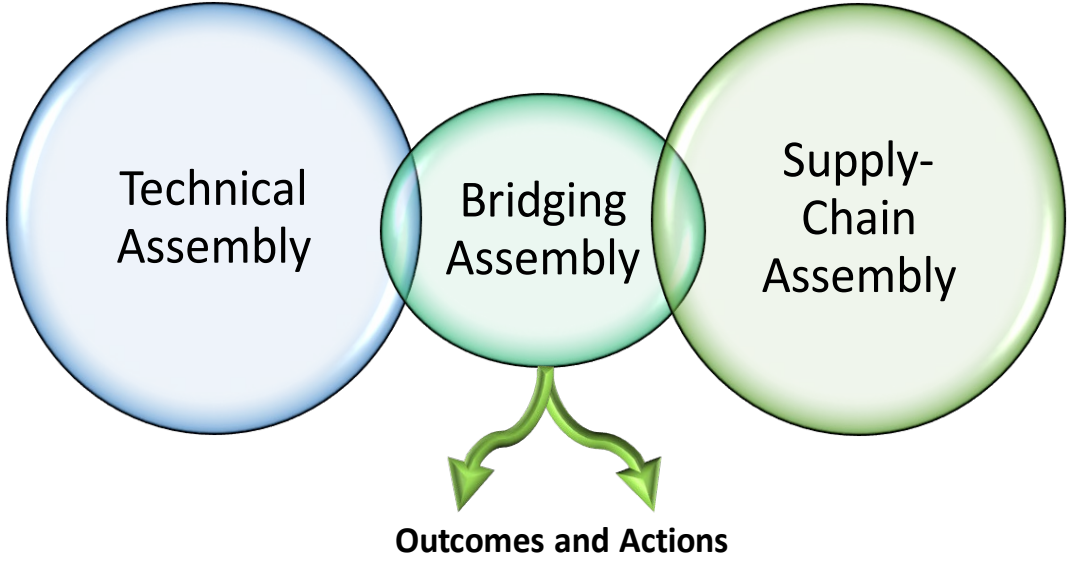
Purpose: To assemble technical and produce industry experts to critically review, aggregate, and unify knowledge surrounding the strong evidence for primary seasonality of STEC outbreaks on leafy greens.

Scope: Identify and prioritize the critical immediate response opportunities and near-term to multi-year fundamental research needs and to disassemble the identified seasonality of contamination and outbreaks attributed to STEC/EHEC with special focus on *stx* 2 *E. coli* O157:H7

CPS Led STEC Seasonality Research Assembly

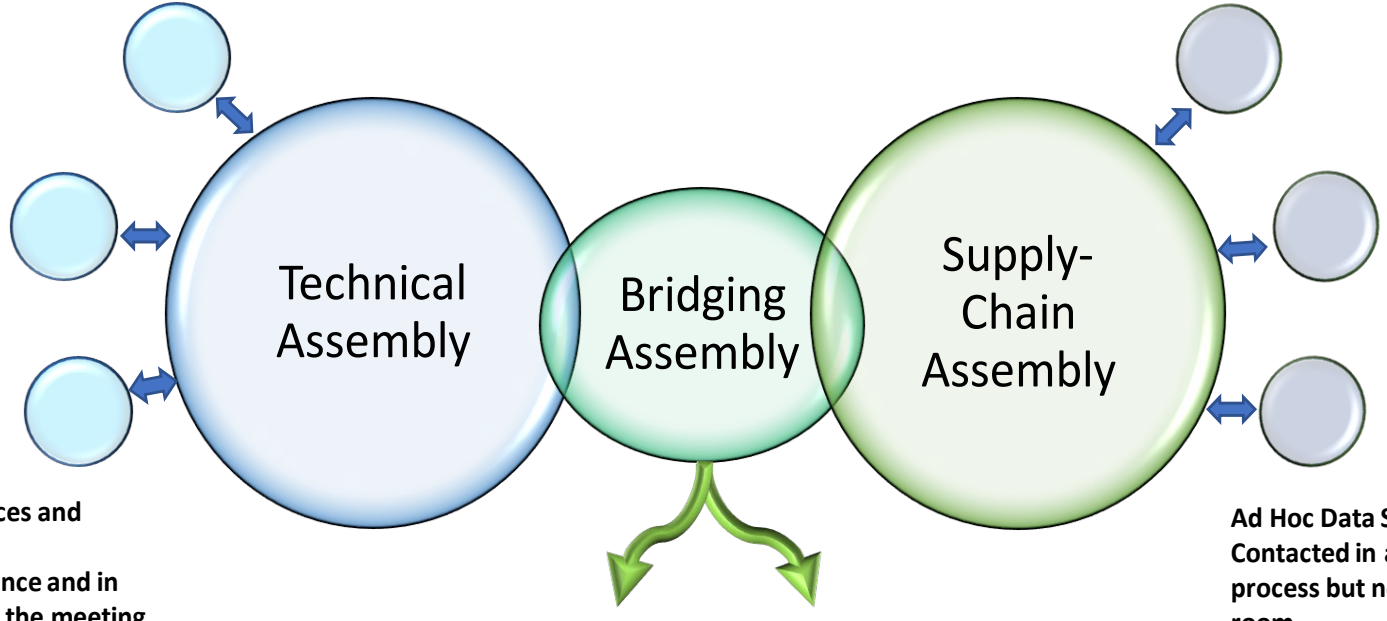
Planned prongs in parallel motion for Data Assembly and Analysis

1. Bring together all industry groups currently taking some investigative and capacity-building activities on these outbreaks to minimize duplication
2. Identify PI-lead for potential NIFA AFRI Conference Grant for broader stakeholder awareness and engagement to precede a multi-year research proposal
4. Identify Lead Institution PI on a potential NIFA SAS proposal and industry Co-PI to lead Industry Oversight panel during proposal preparation and execution if awarded



CPS Led STEC Seasonality Research Assembly

Ad Hoc Data Sources and SME's



Ad Hoc Data Sources and SME's
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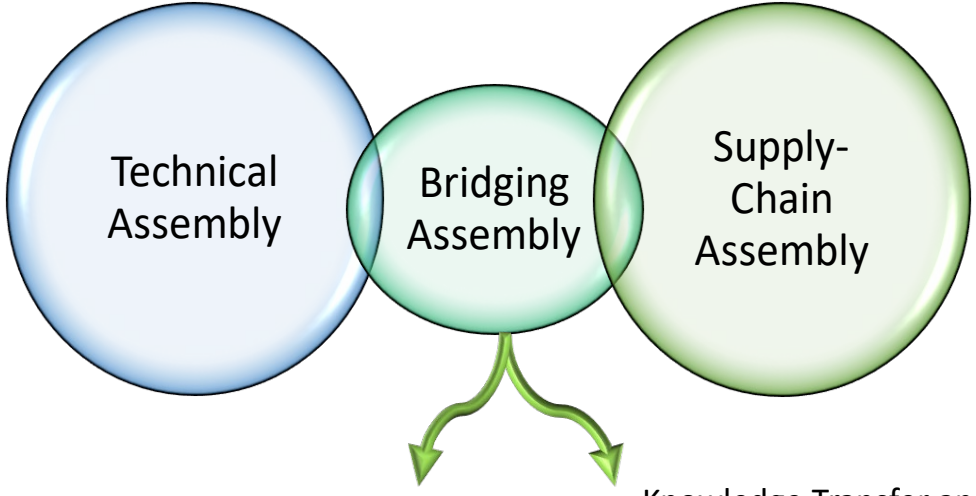


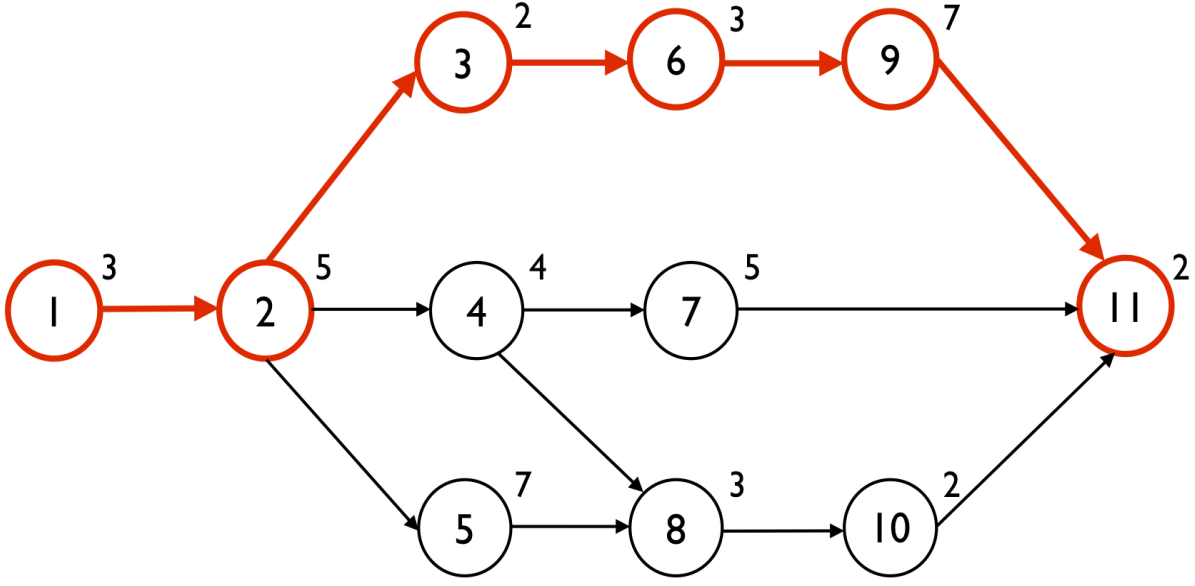
Priority Research and Response Outcomes

- ❑ CPS
- ❑ Industry Coalitions
- ❑ LGMA's
- ❑ USDA NIFA
- ❑ USDA ARS
- ❑ FDA, CDC, State Departments
- ❑ Partnerships across the above

Knowledge Transfer and Coordinated Actions

- ❑ Associations
- ❑ CPS KTTF
- ❑ Industry
- ❑ Extension Outreach
- ❑ Research RFP Submission Planning
- ❑ Media relations
- ❑ Government relations

Assembly SME's will address and develop frameworks for discussion and reports



Critical Path Action Framework

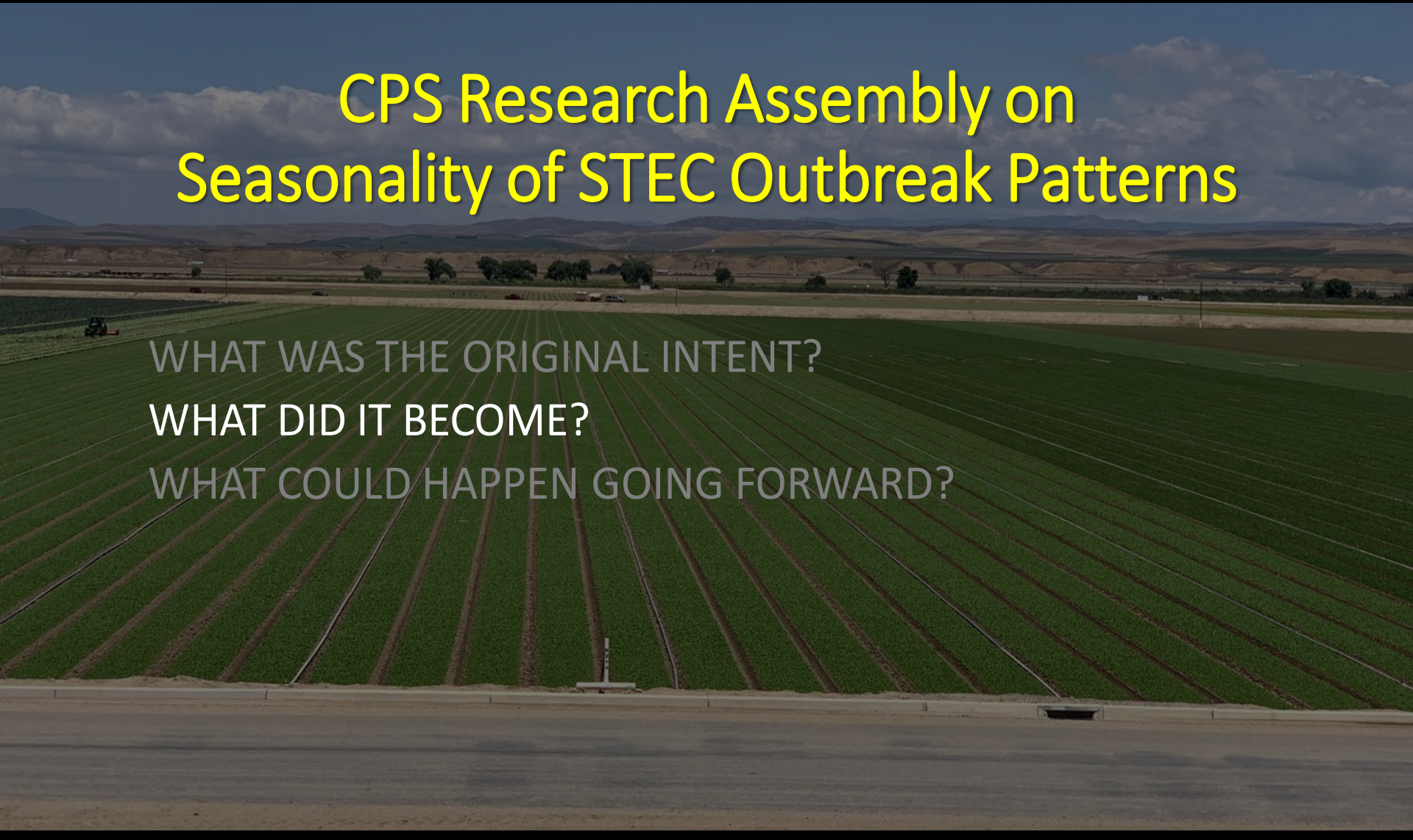
- **A singular, dependent, co-dependent, parallel, intersecting, or overlapping discovery pathway for preventive actions and controls identified by the available data, science, and experience which define the hypothesis generation of root cause key events.**

Assembly SME's will address and develop frameworks for discussion and reports

Key Events Framework

- The known, presumptive, and logically inclusive key factors involved in contamination, cross-contamination, risk amplification, and spatial, temporal, and/or environmental influencers which must be investigated and supported or refuted by the available data. Key Events which cannot be ruled out contribute to defining the priority research questions.

Follow the 5 Whys Process



CPS Research Assembly on Seasonality of STEC Outbreak Patterns

WHAT WAS THE ORIGINAL INTENT?

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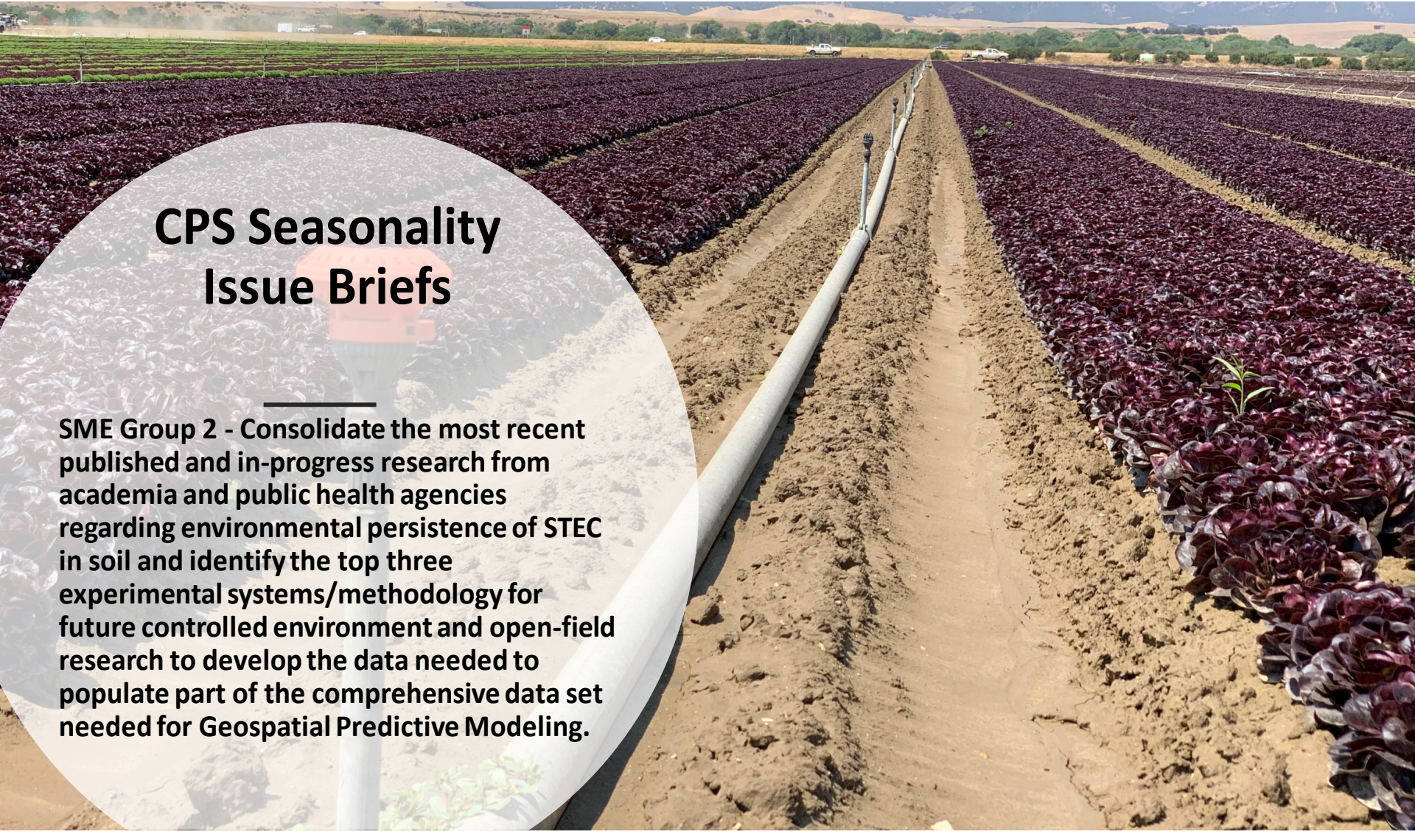
CPS Seasonality Issue Briefs

SME Group 1-What has been learned, what can be learned from the available WGS data, and what questions remain to be answered regarding the genomic relatedness and diversity of the *E. coli* O157:H7 sub-types identified in seasonal outbreaks



CPS Seasonality Issue Briefs

SME Group 2 - Consolidate the most recent published and in-progress research from academia and public health agencies regarding environmental persistence of STEC in soil and identify the top three experimental systems/methodology for future controlled environment and open-field research to develop the data needed to populate part of the comprehensive data set needed for Geospatial Predictive Modeling.

CPS Seasonality Issue Briefs

SME Group 3 - Consolidate the most recent published and in-progress research regarding mid-range and long-range aerosol and environmental transport of bacteria associated with crop and non-crop (pastureland focus) as a model. Identify the top three experimental systems/methodology for future research to develop the data needed to populate part of the comprehensive data set for Geospatial Predictive Modeling.

CPS Seasonality Issue Briefs

- **SME Group 4 - Establish a framework for incorporating the various original aspects of the CPS STEC Assembly as New Research Priorities for collaborative Geospatial Analytics and Geospatial Predictive Modeling. What are the right questions and what is the broadest scope of data sources and information needed to accomplish Root Cause Analysis?**

Brief Overview CPS STEC Seasonality Project

Participation in on-farm research planning and execution

Trevor Suslow
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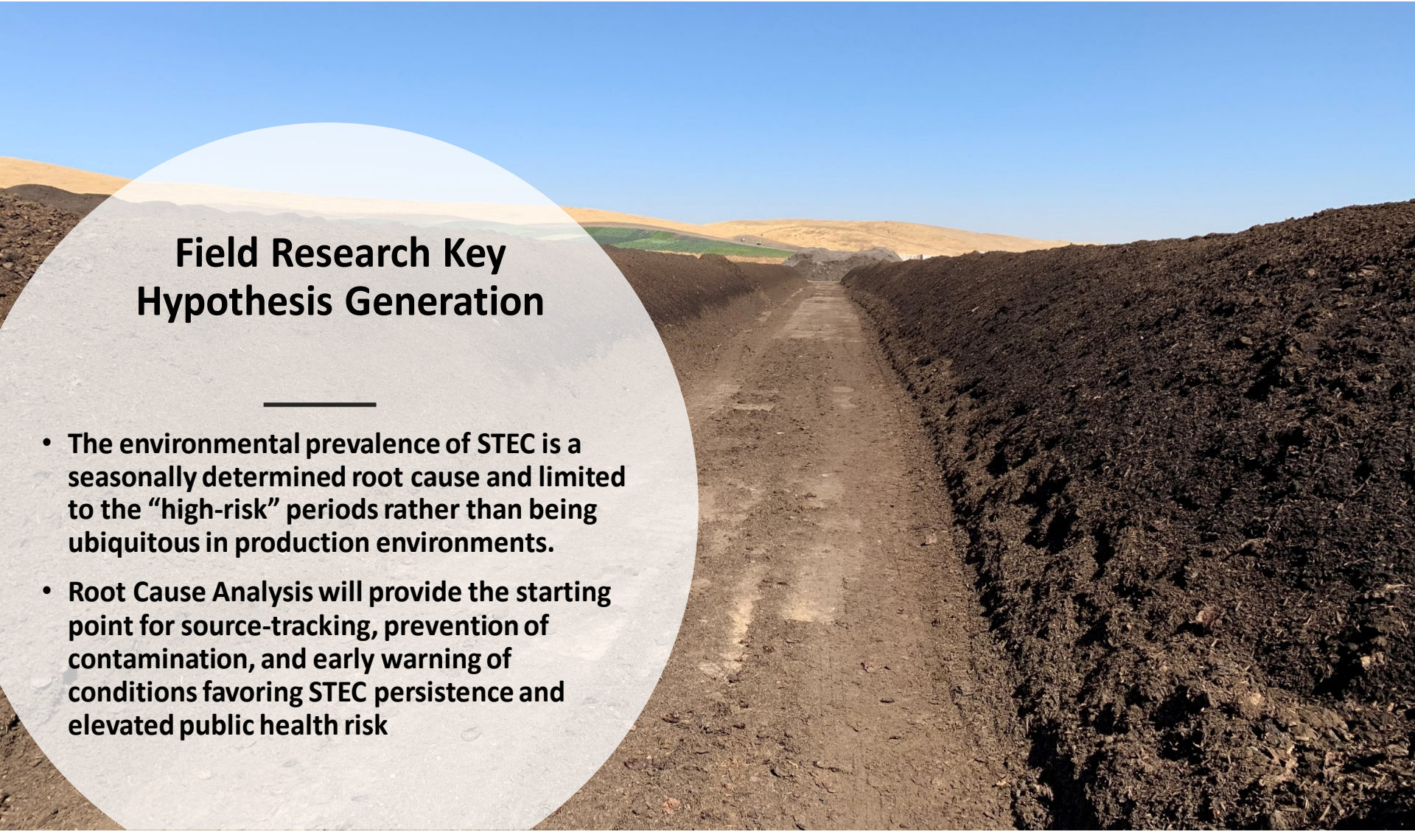


Field Research Key Hypothesis Generation

- The environmental prevalence of STEC is a seasonally determined root cause and limited to the “high-risk” periods rather than being ubiquitous in production environments.
- Root Cause Analysis will provide the starting point for source-tracking, prevention of contamination, and early warning of conditions favoring STEC persistence and elevated public health risk

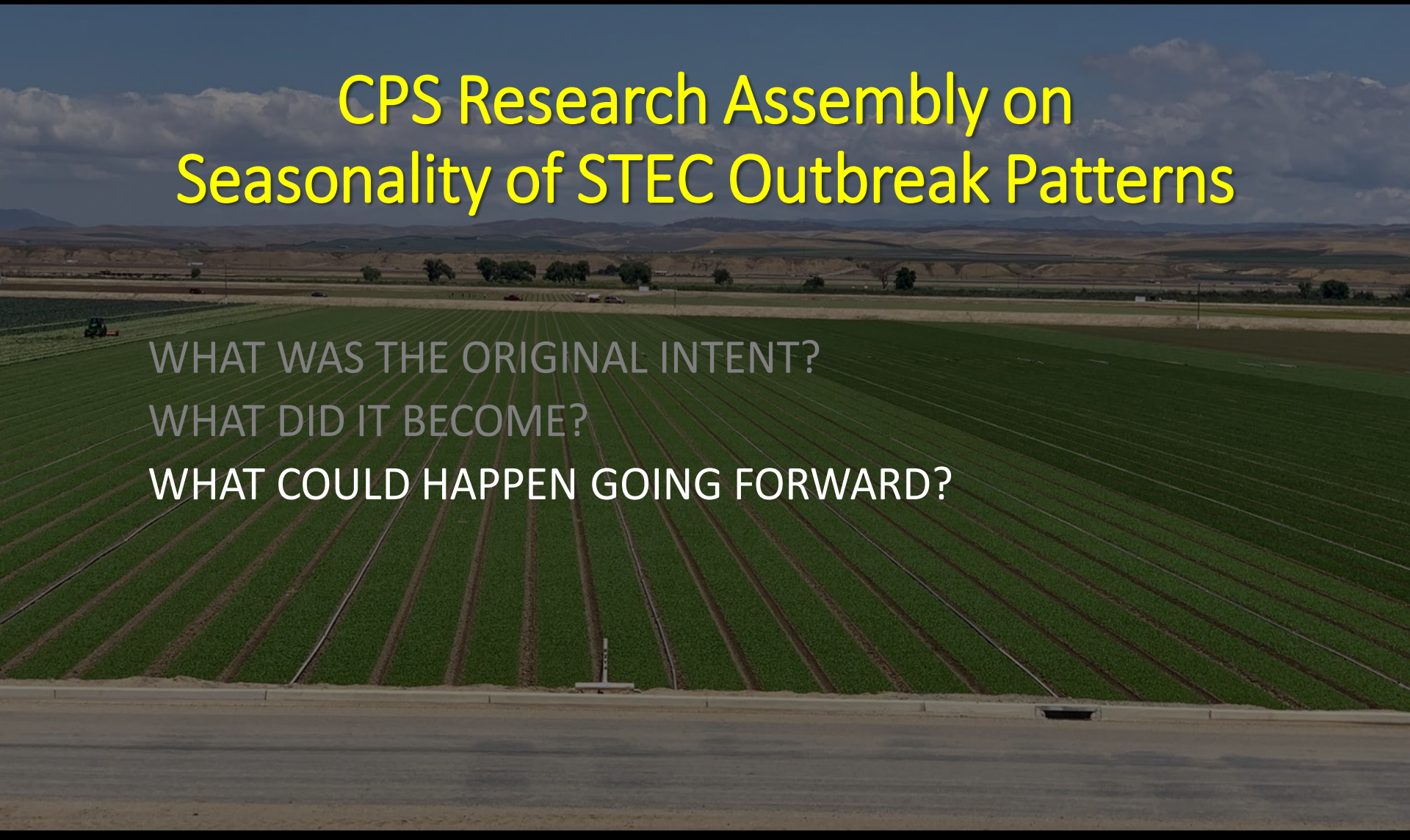
Multiple Parameters Being Monitored for Metadata

- Air and Soil Temperature
- RH
- Wind speed and direction
- Irrigation and fertigation cycles
- Crop management inputs
- Solar UV
- Leaf Wetness (in progress)
- Motion-activated cameras
- Soil and Pooled Water FIB and STEC
- Tissue FIB and STEC
- Other

Sub-objectives planned for CPS STEC project…

- Refine pre-harvest sampling by replicated evaluation of standard leaf tissue testing with whole head sampling on each 1 ac block

- Swab “EMP” evaluations of commercial harvest equipment



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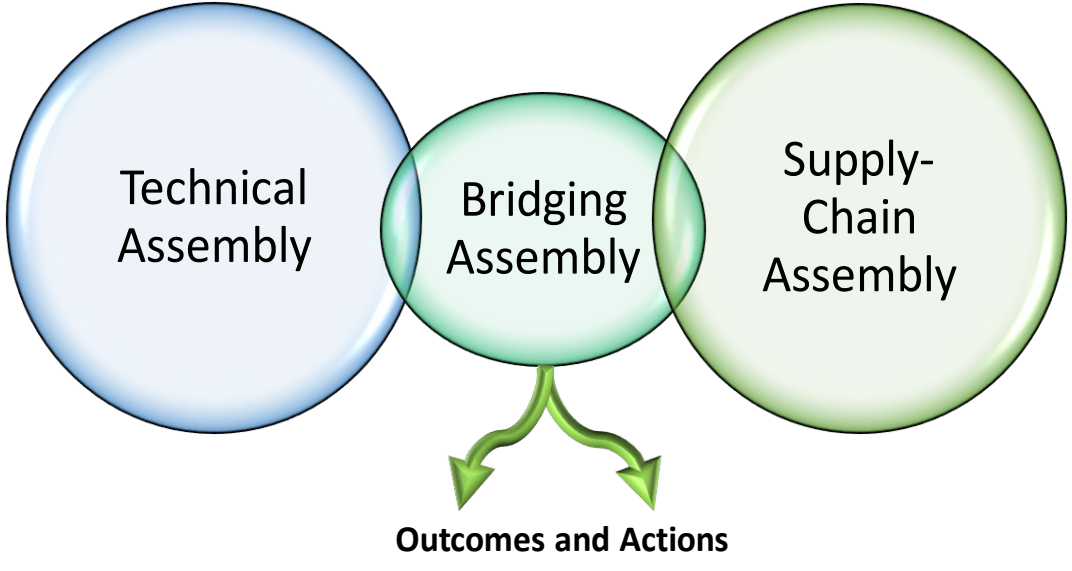
Identify Lead Institution PI on a potential NIFA SAS proposal and industry Co-PI to lead Industry Oversight panel during proposal preparation and execution if awarded



Brief Overview of CPS STEC Seasonality Project

Thank you for your attention

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pma PRODUCE MARKETING ASSOCIATION

Intro: Data analytics

Presented by Sonia Salas

Quick Poll

1. How often are you analyzing food safety data?

   A. We analyze for trends on a regular basis
   B. Only analyze on an event-based basis
   C. Both regularly and event-based
   D. We are not analyzing for trends (only storing for compliance)
   E. Unsure how often

Data Analytics and the Power of Data

"Data analysis is a process of inspecting, cleansing, transforming and modeling data with the goal of discovering useful information, informing conclusions and supporting decision-making." – *Source Wikipedia*

"Never before in history have we had as much available data as we do today to detect and prevent foodborne illnesses, so people can live better." *Frank Yiannas 2015 - Quote from WG's webinar on Big Data.*

Source: Big Data WG's Webinar 2015, Frank Yiannas

Data Analytics and the Power of Data

BOTTOM LINE: Data has the potential to successfully address challenges

- Two key FDA announcements this year:
    - Leafy Green STEC Action Plan – to advance the safety of leafy greens (Leafy Green Data Trust – public-private data trust for leafy greens).
    - *New Era of Smarter Food Safety Initiative – New approach to food safety for safer, more digital, traceable food system.*

WG' data efforts are meant to address the need to analyze data and inform food safety efforts.

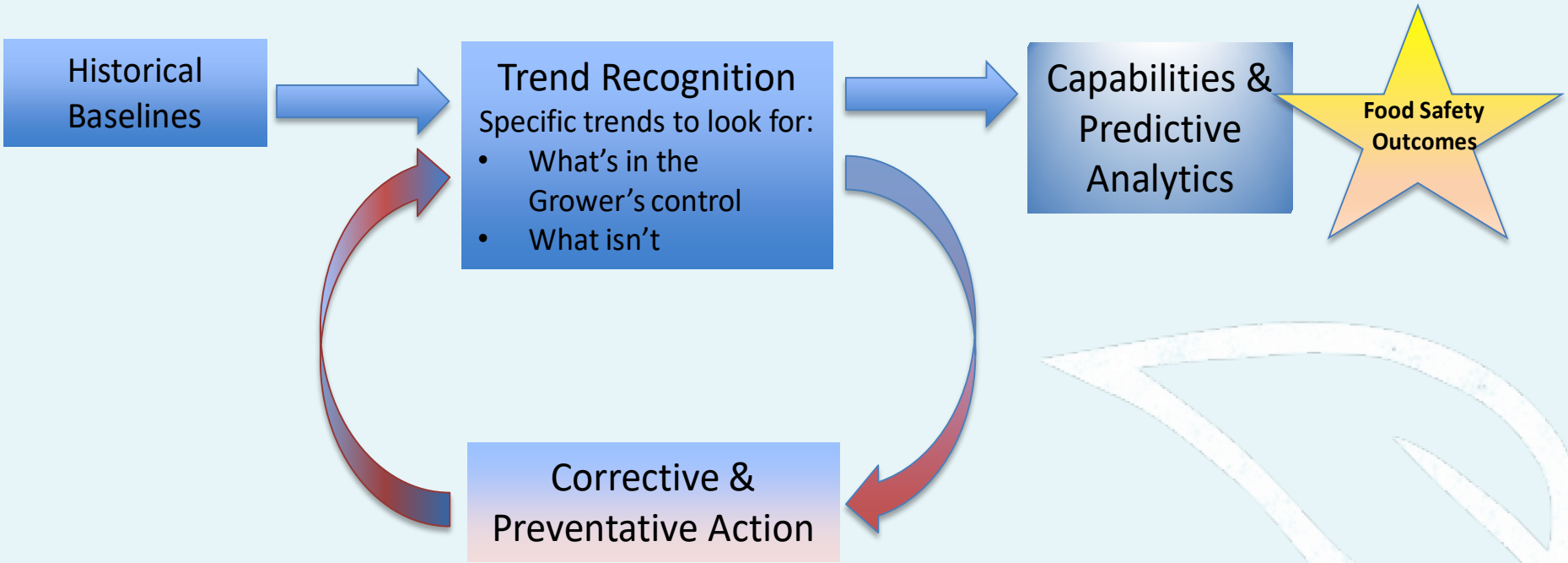
WG Data Efforts that could address seasonality issues

Presented by Marlene Hanken

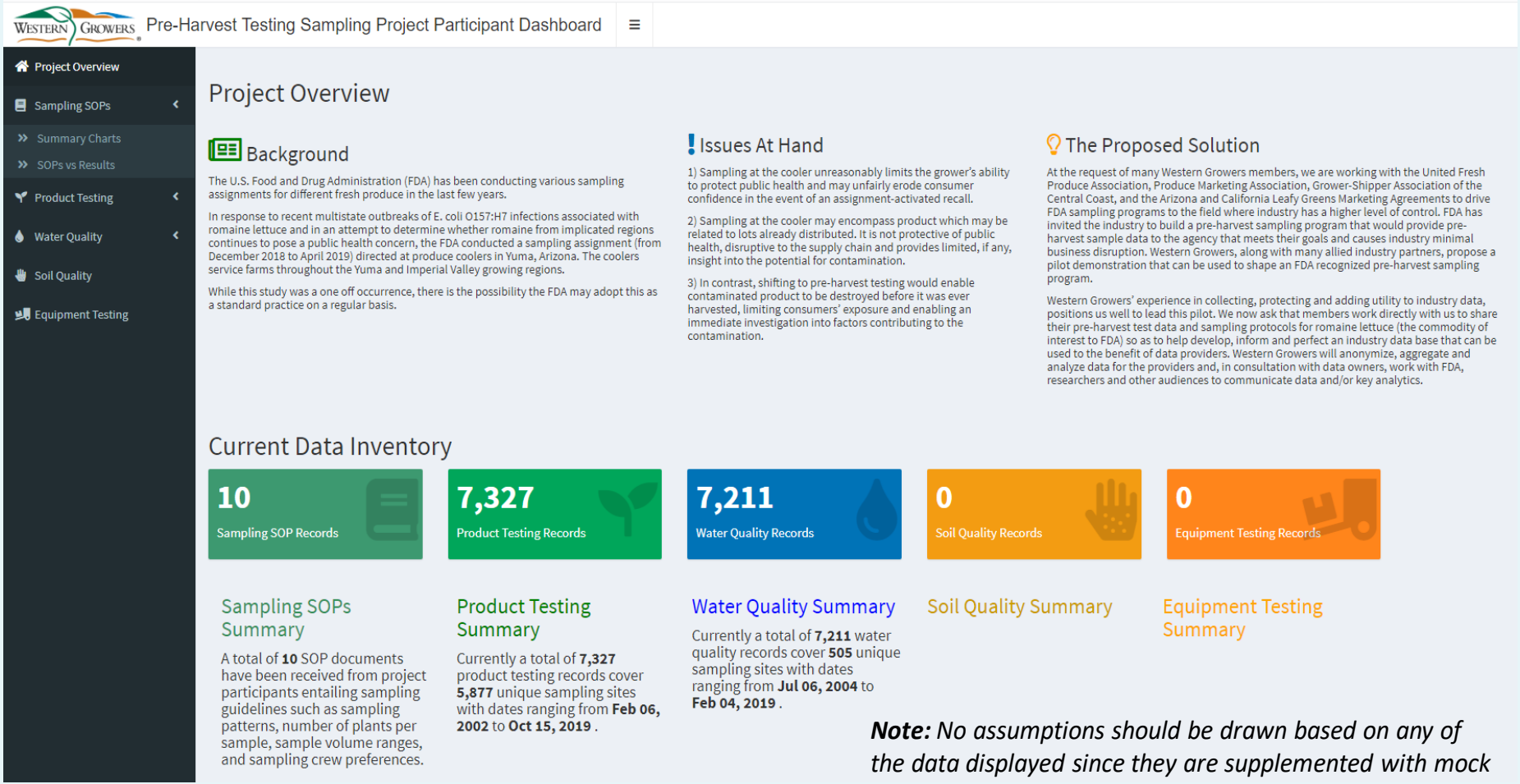
Current Projects in the following categories:

- Demographics
- Food Safety
- Environmental Performance

Data Analysis Stages



Pre-Harvest Sampling Testing



Note: *No assumptions should be drawn based on any of the data displayed since they are supplemented with mock data to illustrate possible uses of this tool.*

Pre-Harvest Sampling Testing

Product Testing Results Trends

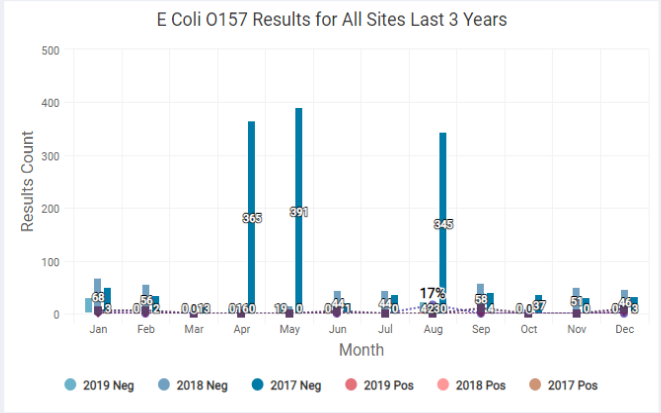
All Sites

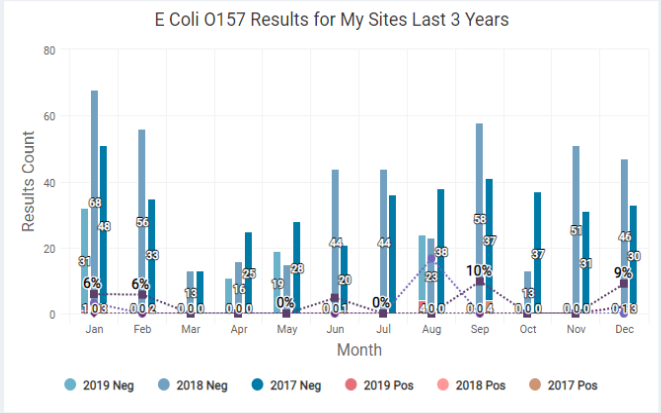
My Sites

Data Scope

Select Target Organism

- E Coli O157
- EHEC
- L Mono
- Salmonella
- STEC





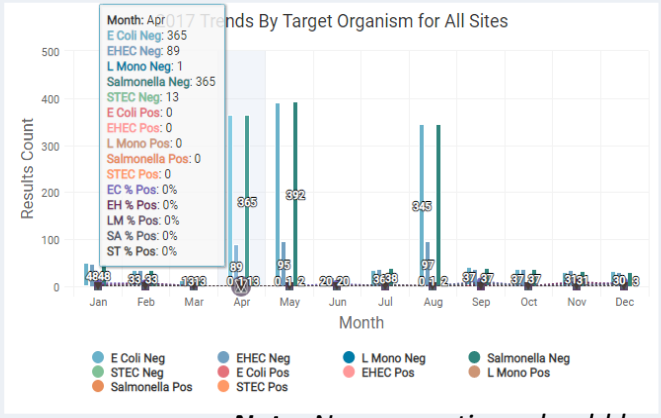
Data Scope

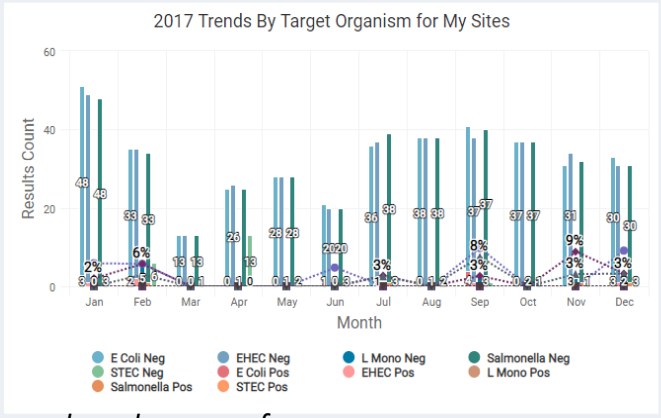
Select Year

- 2019
- 2018
- 2017

*Note:

Trends are restricted to data submitted with Sample Dates





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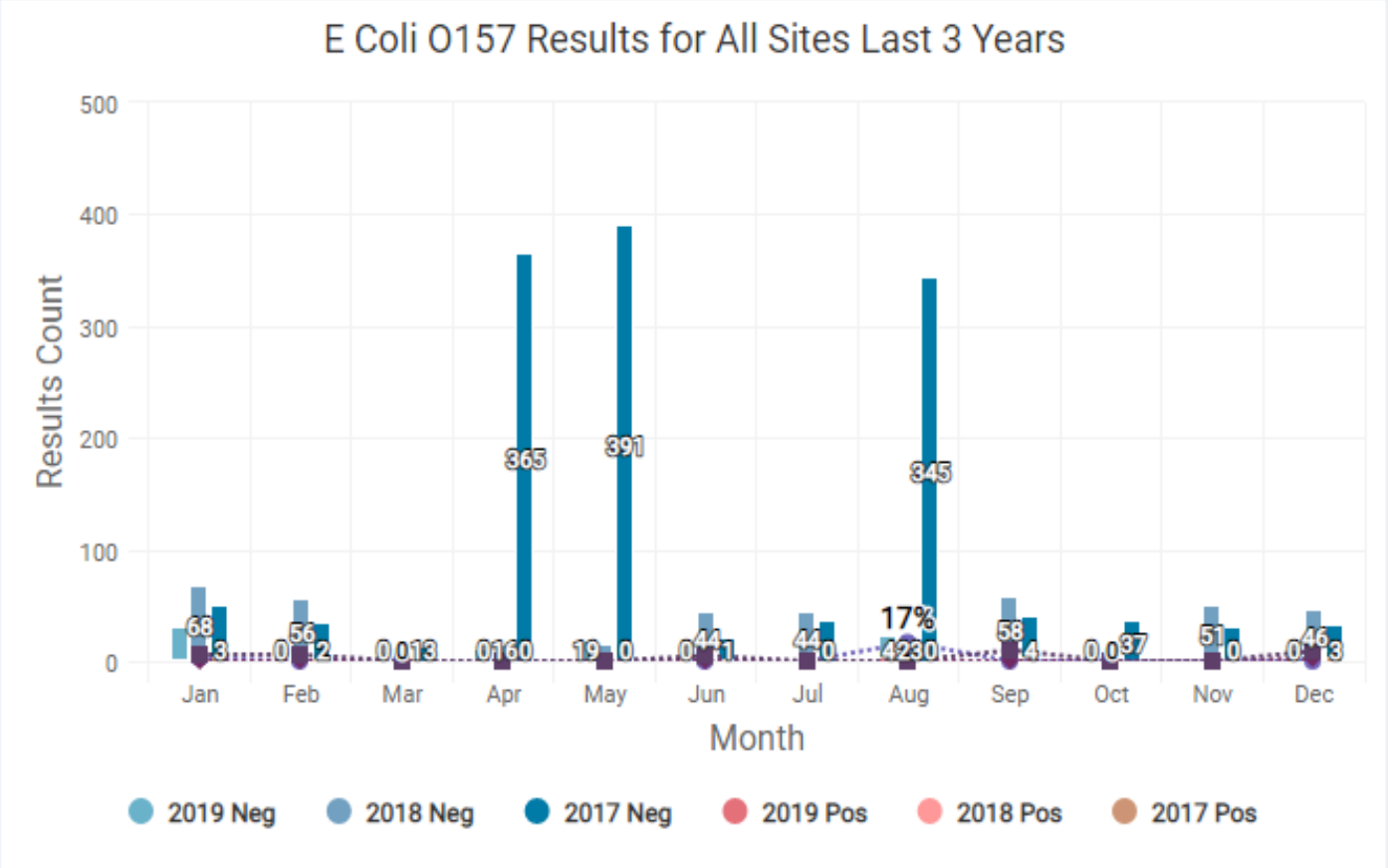
Pre-Harvest Sampling Testing



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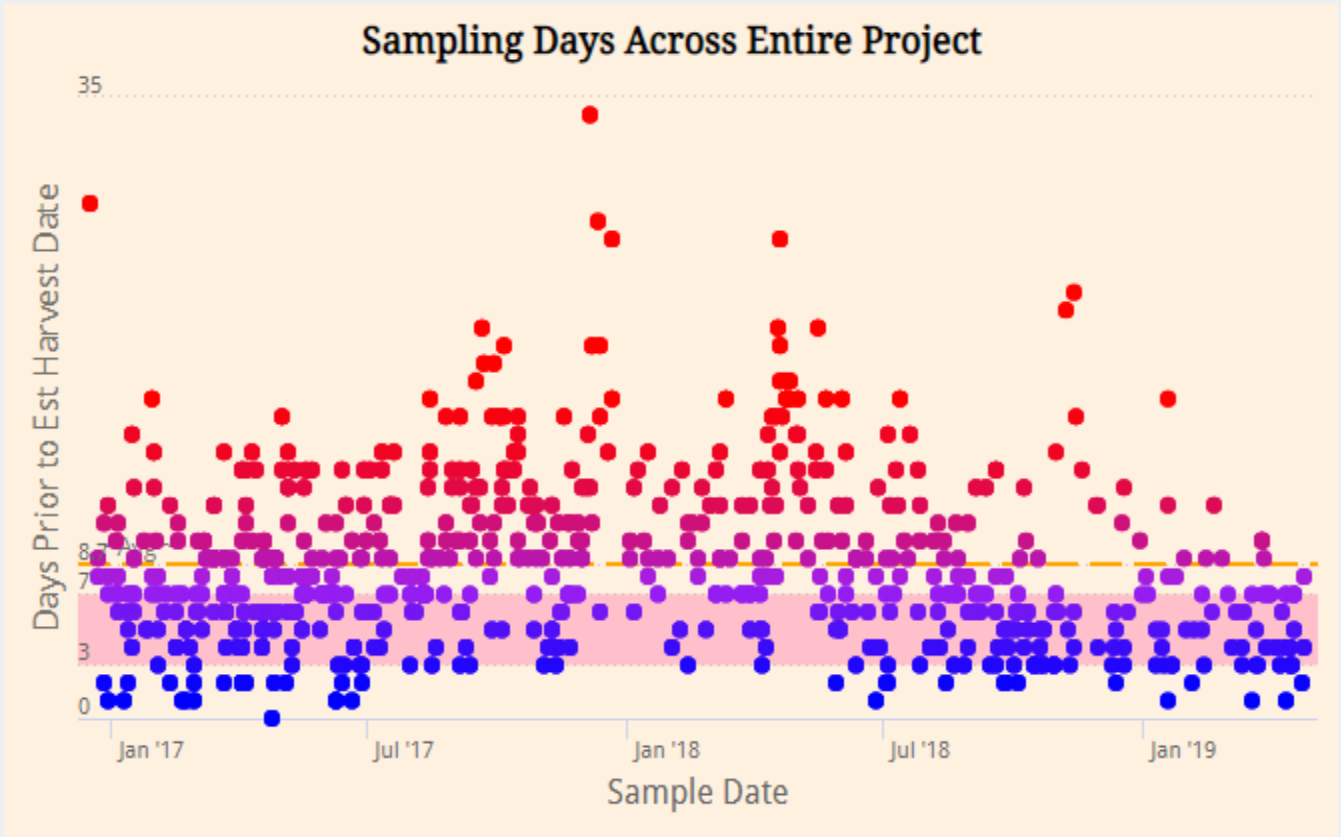
Pre-Harvest Sampling Testing



Note: *No assumptions should be drawn based on any of the data displayed since they are supplemented with mock data to illustrate possible uses of this tool.*

Contact

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Science Department

Pre-Harvest Sample Testing Program
data@wga.com

Q&A Session

Thank You!