Produce Safety Research at the Office of Applied Research and Safety Assessment

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CFSAN/FDA

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Introduction

- FDA is responsible for ensuring the safety of all domestic and imported fruits and vegetables.
- Develop control and preventive measures.
- The Produce Safety Rule was published in November 2015 and a risk assessment that was conducted by FDA led to the conclusion that use of poor agricultural practices could lead to contamination and illness.
  - both pre-harvest and post-harvest:
    - agricultural water,
    - biological soil amendments of animal origin
    - worker health and hygiene
    - equipment, tools
    - buildings and sanitation
    - domesticated and wild animals
    - growing, harvesting, packing and holding activities.

OARSA Produce Safety Research Consortium

A research network with collaborative partners from academia and government agencies (*UGA, USDA-ARS, NCSU, OSU, and FDA/CFSAN/OARSA*) to

- ***Leverage*** on-going projects
- ***Facilitate*** collaborations
- ***Provide*** produce-related and on-farm environmental collections for prioritized and identified research areas
- ***Facilitate*** and fill data gaps through observational and experimental studies
- ***Expand*** OARSA's contributions to complement other ongoing PS research programs and to GenomeTrakr

Specific Objectives

- Compare prevalence of different bacterial pathogens (*Salmonella, Listeria monocytogenes, Campylobacter,* STEC), viruses (HAV, NoV), *Cyclospora cayetanensis*
- Compare regional and farming practice differences for soil microbiome and presence of pathogens.
  - Focus on raw manure, treated manure and untreated manure
- Investigate presence of pathogens and survival in different water sources (and drip tape where applicable)
  - Compare regional and seasonal differences
- Investigate the physical and chemical properties and moisture content of soil from farm soils in produce production facilities from different regions in North America
- Investigate the relationships between foodborne pathogen survival and persistence, and the different soil compositions (untreated vs BSAAO vs BSA) and soil microbiome diversity

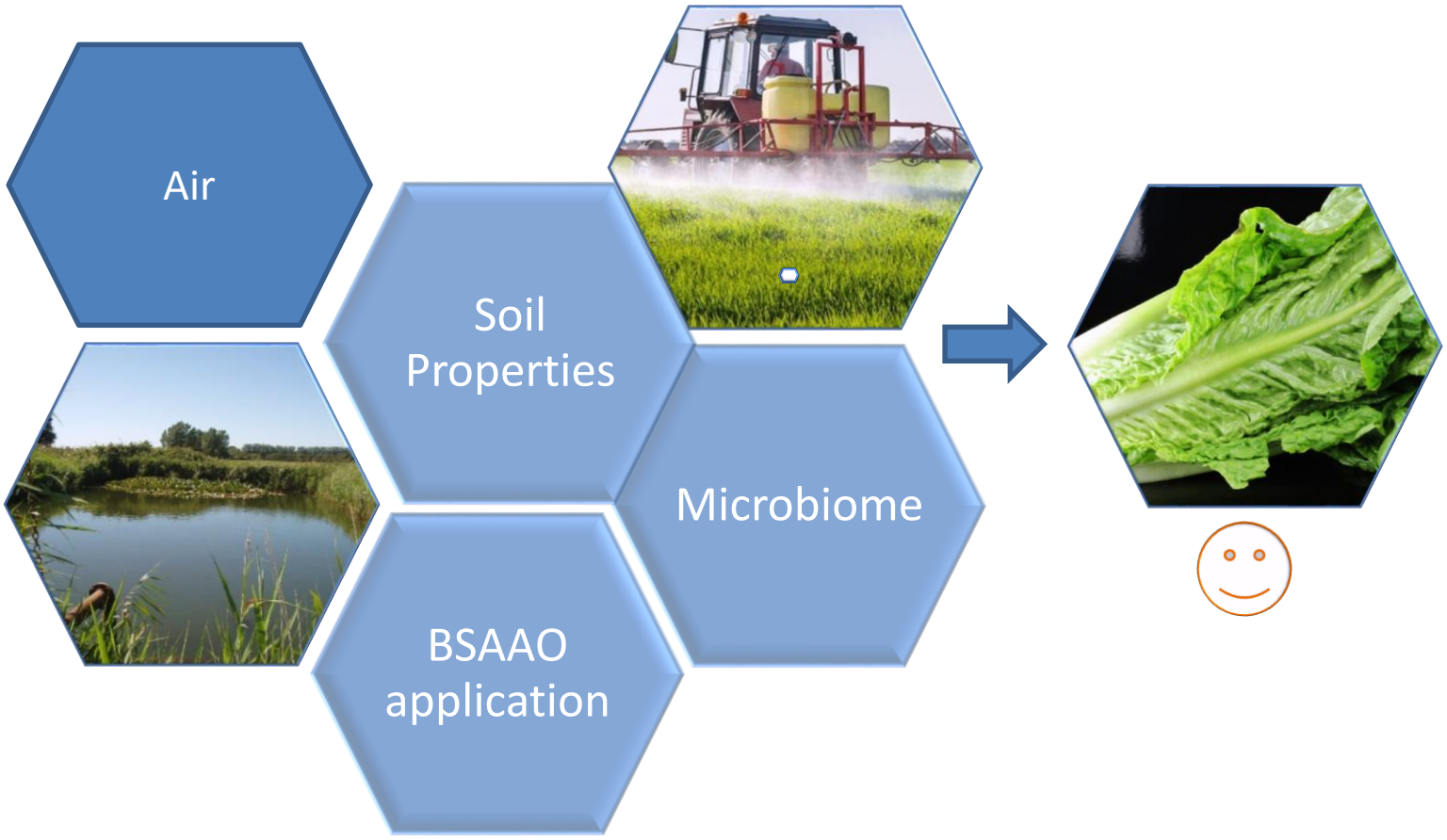
Specific Objectives cont.

- Microbiome (Indicators)
  - Soil (amended and non amended)
  - Water
  - Produce
  - Presence of antibiotic resistance genes
- Determine potential transfer from water, soil to plant to produce for bacteria and viruses
- Collect metadata
  - Amendments
    - Is the soil amended?
    - What is the amendment?
    - How much and how often are the amendments applied?
  - Animal husbandry
    - Distance of animal feeding to planting fields

Contributions of the PSRC to This Work

- Provides water source, soil and produce samples from the natural environment.
- Provides isolates; DNA
- Provides a conduit to gain information about field management and topology that could explain observed patterns.
  - Can we discern impact of watershed or farmer practices on resident pathogens and microflora?
- Metadata

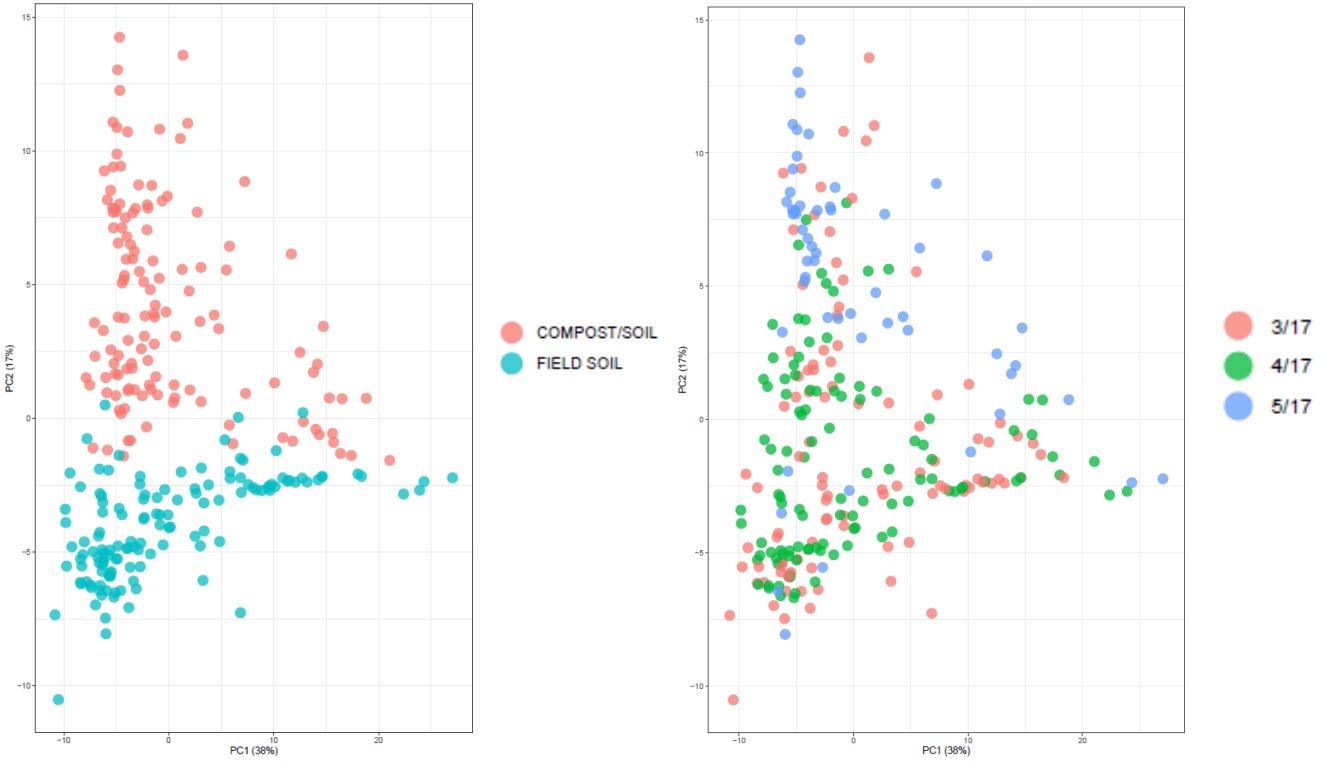
Adding More Pieces To Solve The Puzzle?



Soil amendment applied on Ohio and Georgia fields

Type of Field Amendment
dairy manure (DM)
composted dairy manure (CDM)
poultry manure (PM)
composted poultry manure (CPM)
no biological soil amendment (N)
fallow fields (F)
green compost (GC)

Soil Microbiome Sample Diversity

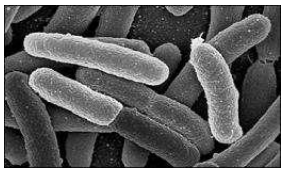


Processing lettuce for storage

harvest

cut and wash

Salinas, CA



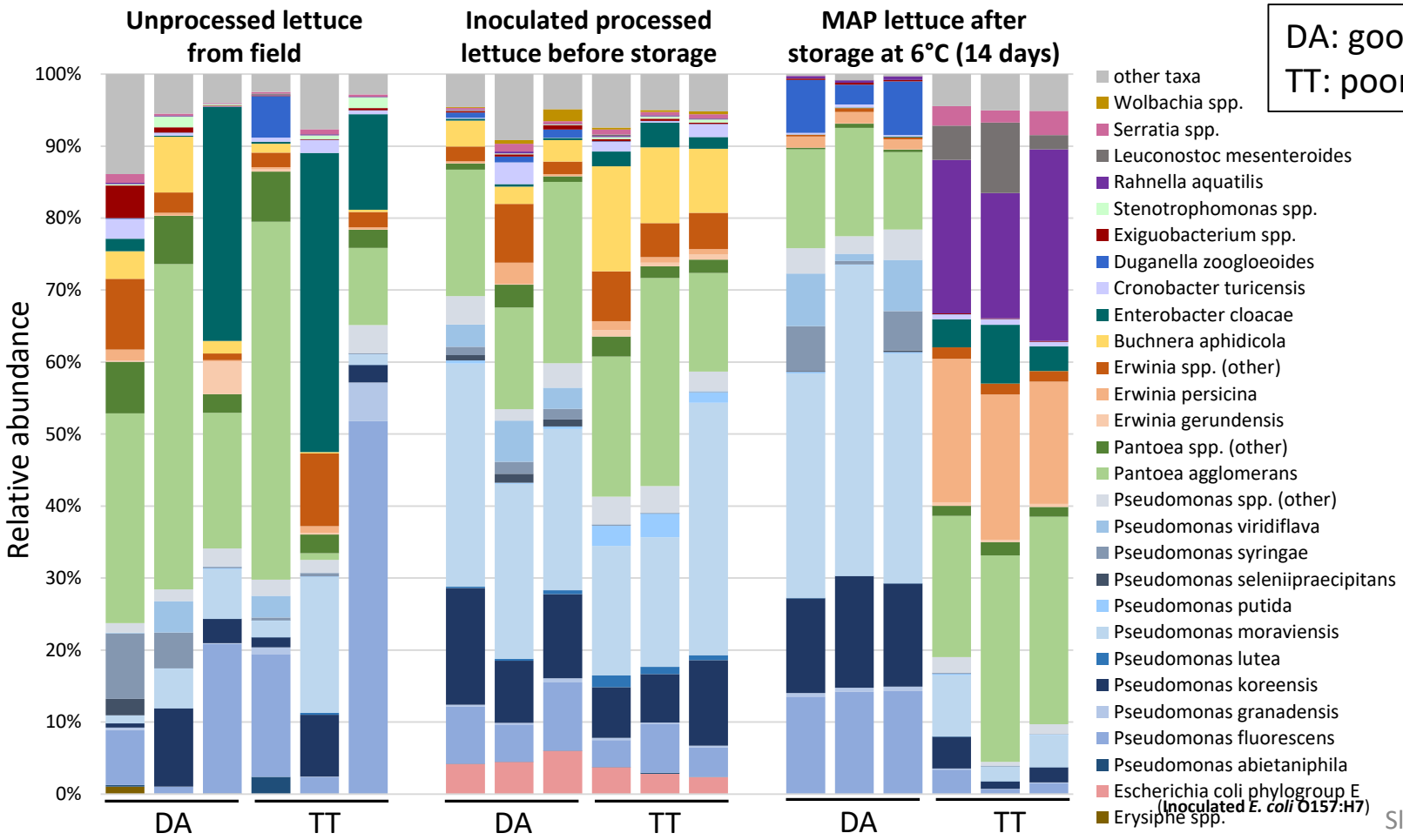
Inoculation with *E. coli* O157:H7
(stx -, rif +)

Albany, CA

Modified
Atmosphere
Packaging

Microbiomes of lettuce: field through storage
USDA ARS field, spring 2018

Pseudomonadaceae/(*Erwiniaceae+Enterobacteriacea*) ratio different in the two romaine lettuce varieties after cold storage



Summary

- Third year
- Preliminary data
  - Data not all analyzed yet; still in the process of testing
- Soil between GA and OH very different in texture, moisture
- Developing new methods for detection, esp. soil/water
  - Viruses
  - *Cyclospora*
  - Bacterial pathogens
  - Role of metagenomics

Future Directions

- Analyze 3 year data to determine where to focus
- Growth Chambers
  - Irrigation type
  - Air flow
  - Humidity
  - Temperature
  - Soil type and pathogen survival/persistence
  - Transfer efficiency

THANKS FOR YOUR ATTENTION!