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

Marianne Miliotis-Solomotis, Ph.D.

Office of Applied Research and Safety Assessment (OARSA)

CFSAN/FDA

**North Central Region Center for FSMA Training, Extension, and Technical
Assistance**

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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
- ❑ 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
- **Support** PS Rule and FSMA
- **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
 - Compare different irrigation practices
- 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

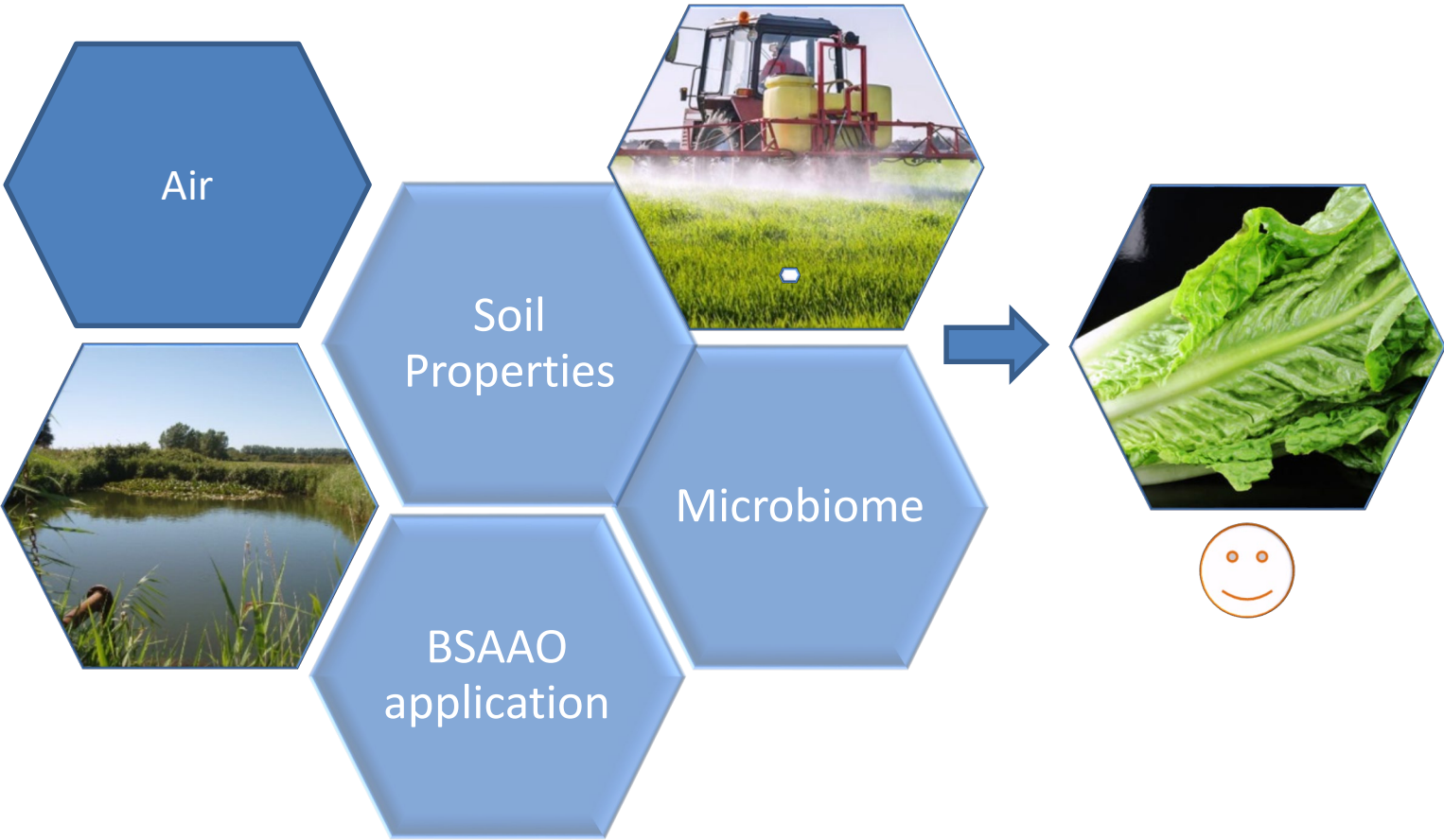
Specific Objectives cont.

- Microbiome (community members; indicators)
 - Soil (amended and non amended)
 - Water
 - Produce
 - Presence of antimicrobial 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?
 - When is it applied?
 - How much and how often is the amendment applied?
 - Animal husbandry
 - Animals on the farm
 - 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

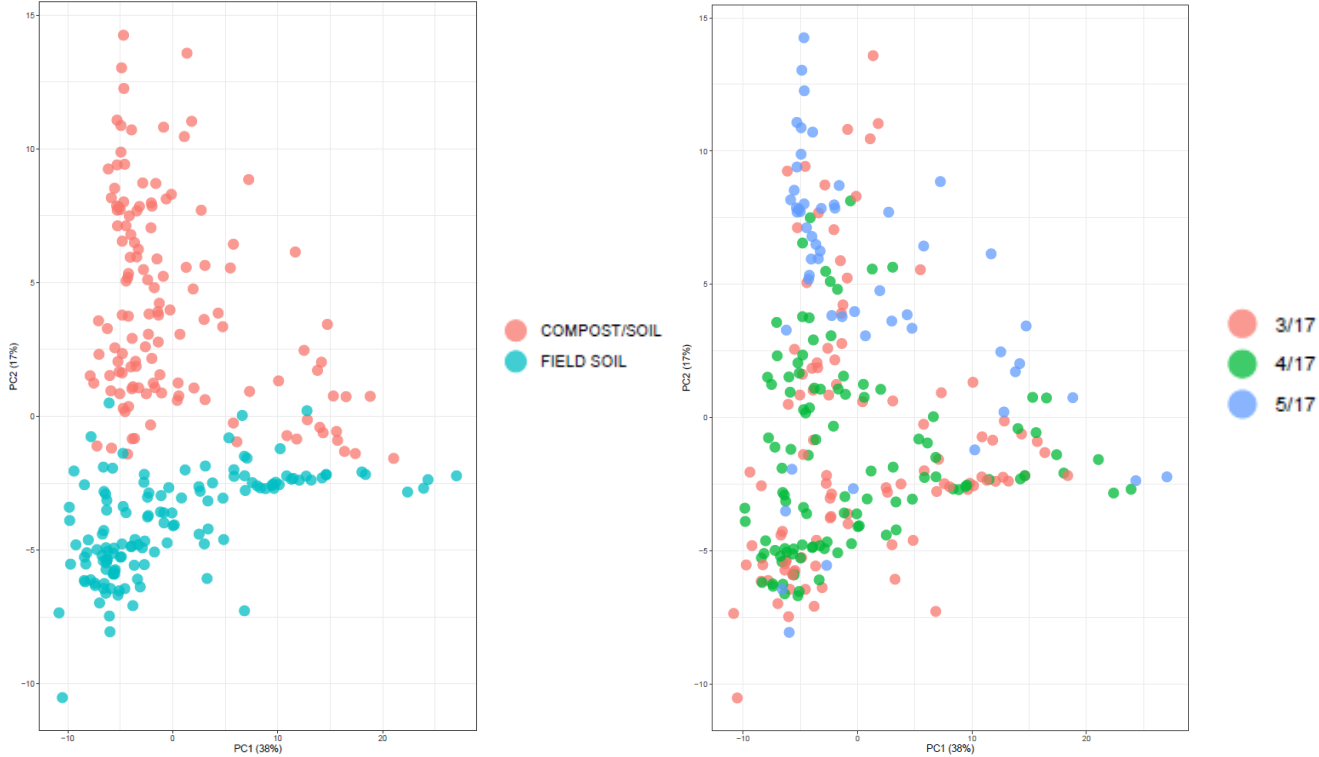
Adding More Pieces To Solve The Puzzle?



Soil amendment applied on Ohio and Georgia fields

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

Soil Microbiome Sample Diversity



Processing lettuce for storage



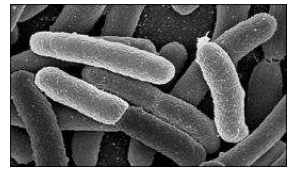
harvest



cut and wash



Modified Atmosphere Packaging



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

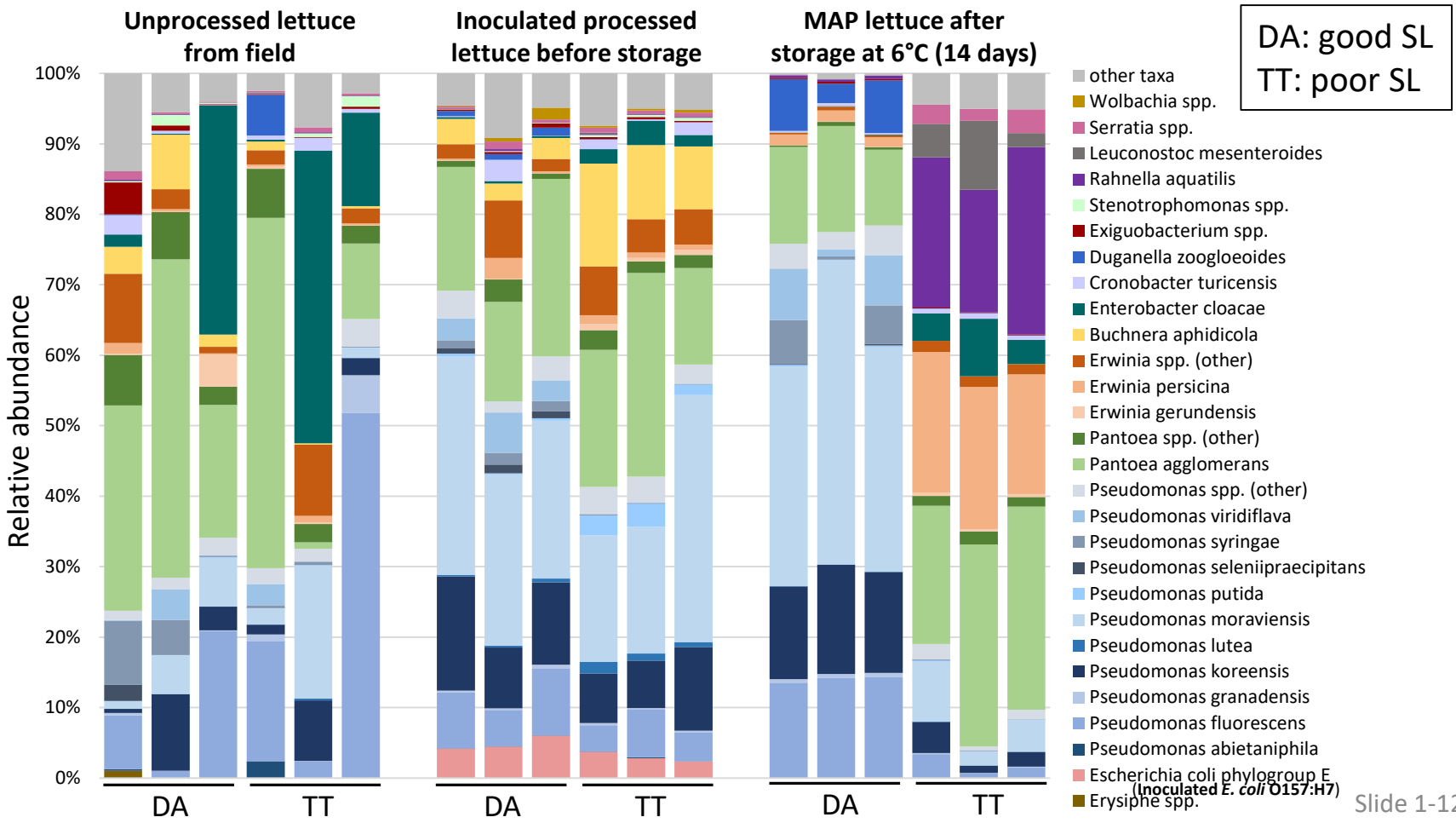
Salinas, CA

Albany, CA

Microbiomes of lettuce: field through storage

USDA ARS field, spring 2018

Pseudomonadaceae/(*Erwiniaceae*+*Enterobacteriaceae*) 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/modified methods for detection, esp. soil/water
 - Viruses
 - Cyclospora*
 - Bacterial pathogens
- Role of metagenomics

Future Directions

- Analyze 3 year data to determine where to focus
- Expand the PSRC
- Growth Chambers
 - Simulating real life environmental conditions
 - Humidity
 - Temperature
 - Irrigation type
 - Air flow
 - Soil type and pathogen survival/persistence
 - Transfer efficiency
 - Oocyst sporulation

THANKS FOR YOUR ATTENTION!