Microbial food safety risks of reusing tail water for production of leafy greens

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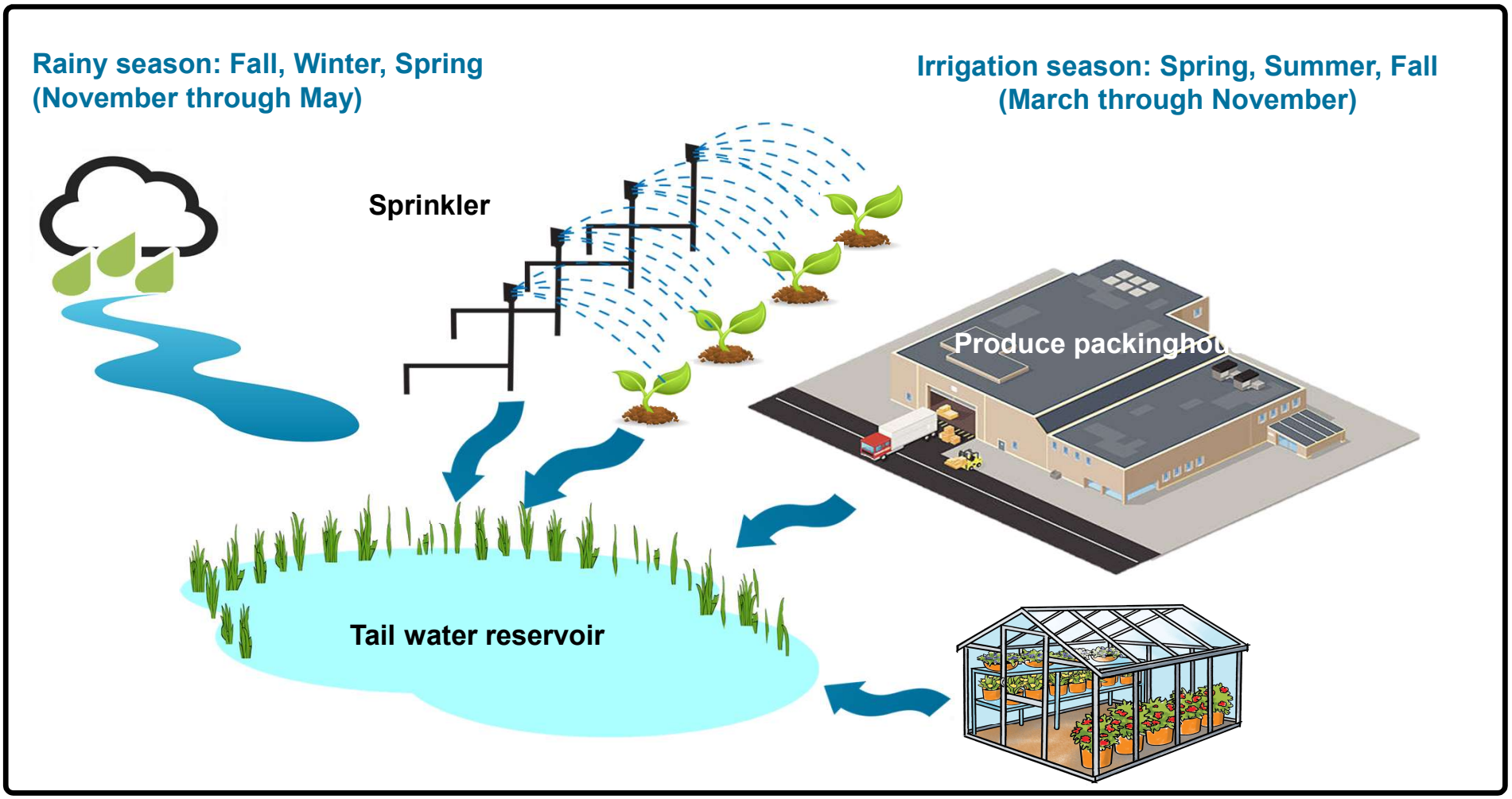
1. **Microbiological characterization of tail and irrigation water**

2. **Risks of using tail water in leafy greens production**

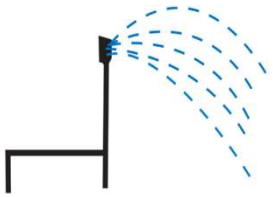
Tail water


Rainy season: Fall, Winter, Spring
(November through May)
Irrigation season: Spring, Summer, Fall
(March through November)
Sprinkler
Produce packinghou
Tail water reservoir

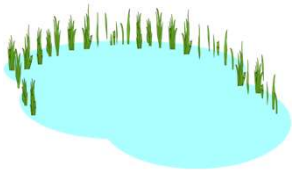
Collection sites

5 farms sampled every month between March 2016 to March 2017

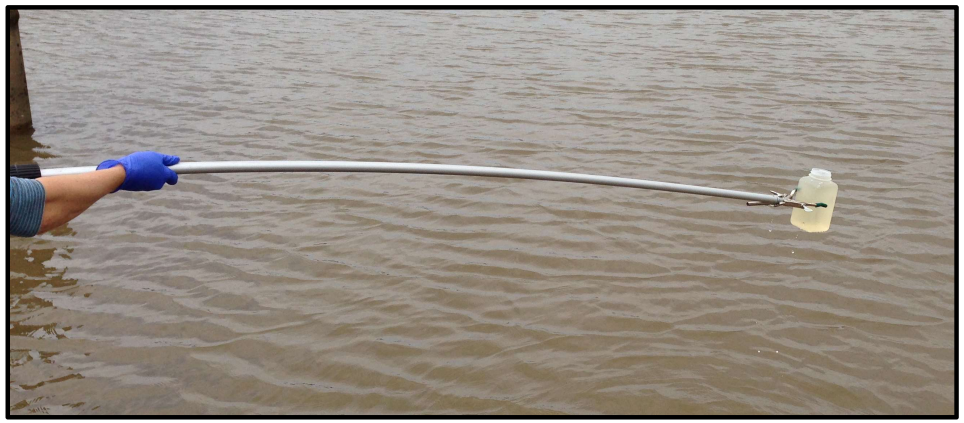
5 irrigation water



6 tail water reservoirs



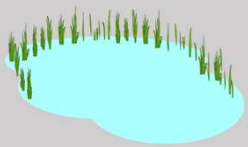
Grab bottles for bacterial enumeration and chemical composition



Moore swab for pathogen detection

Moore Swab

Tail water reservoir

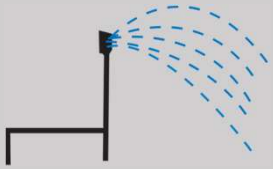


2 x 1 liter grab bottles combined: 82 samples

3 Moore swabs left for 3 days: 229 samples

Grab bottle for bacterial enumeration

Sprinkler head



Automated sampling pump system: 26 samples

1 Moore swab left in collection container: 26 samples

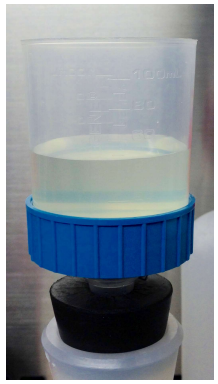
Moore swab for pathogen detection

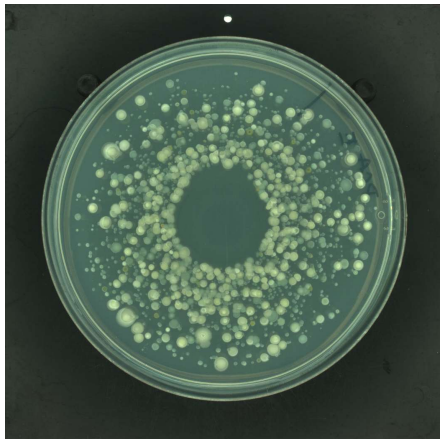
Sample processing for bacterial enumeration and pathogen detection

Water

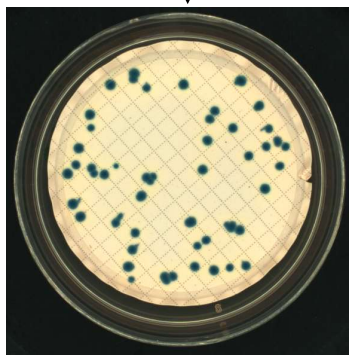
Plating

Filtering





Aerobic plate count



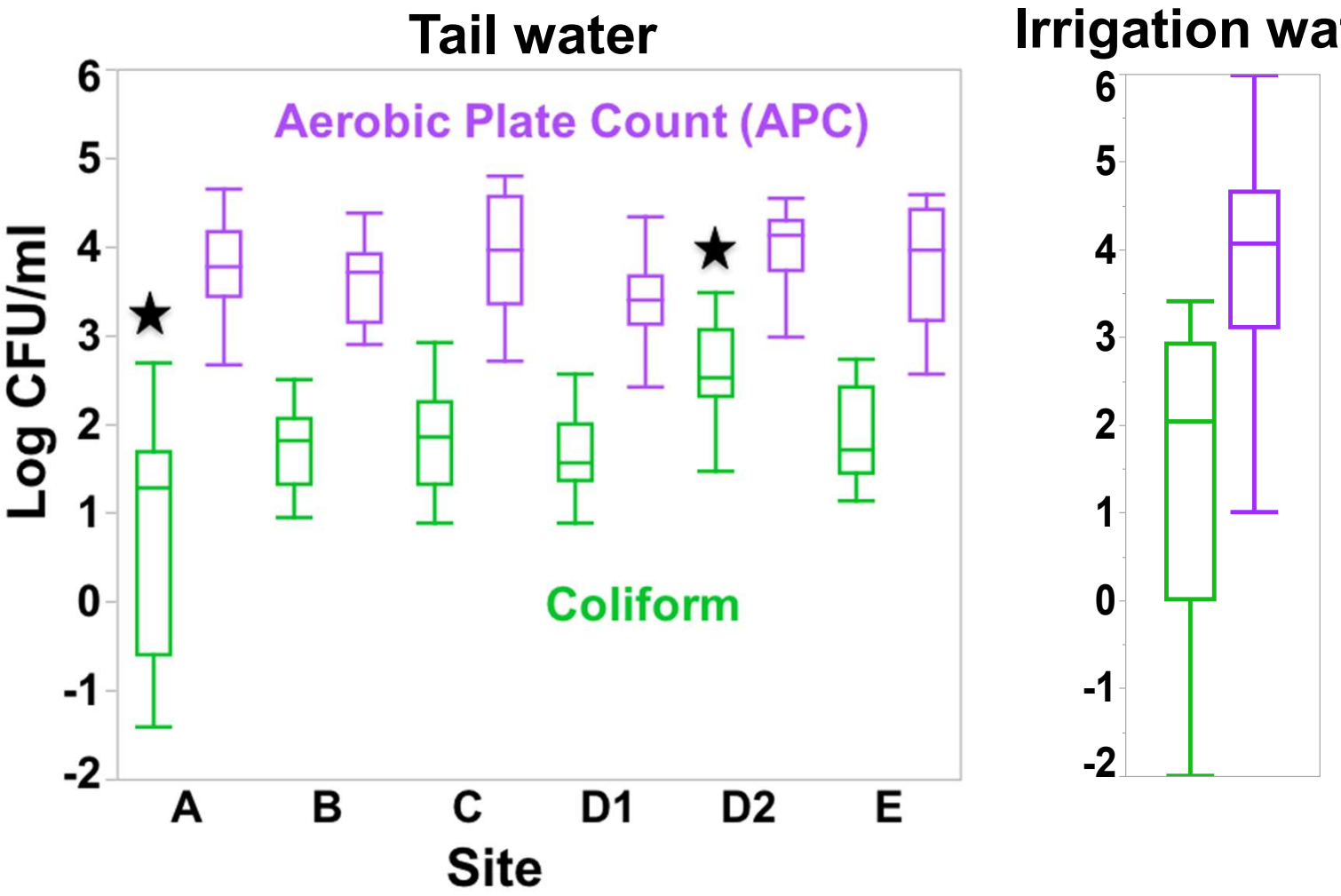
Quantification of *E. coli* and coliforms

Enrichment

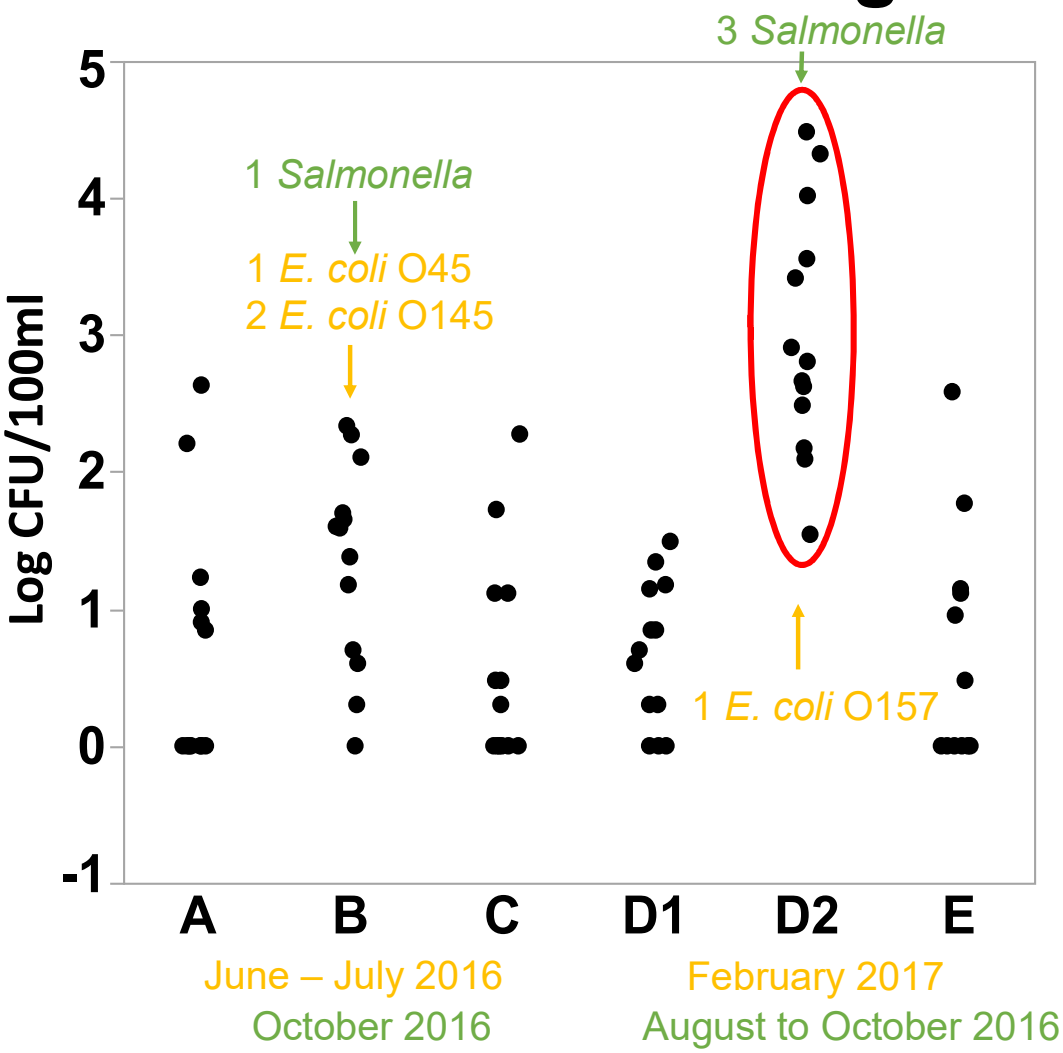
Detection of *Salmonella* and STEC

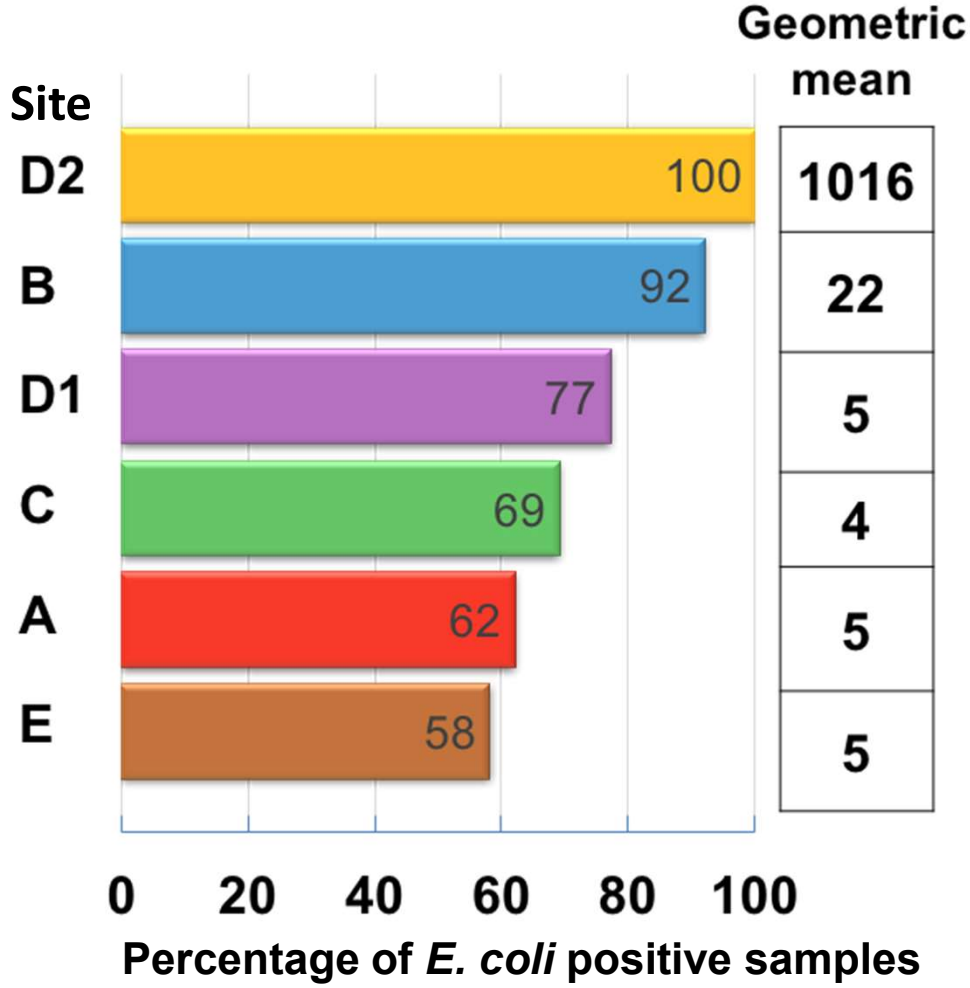
Aliquot and froze
Kept at -80ºC for 6 months

Microbial composition of tail and irrigation water

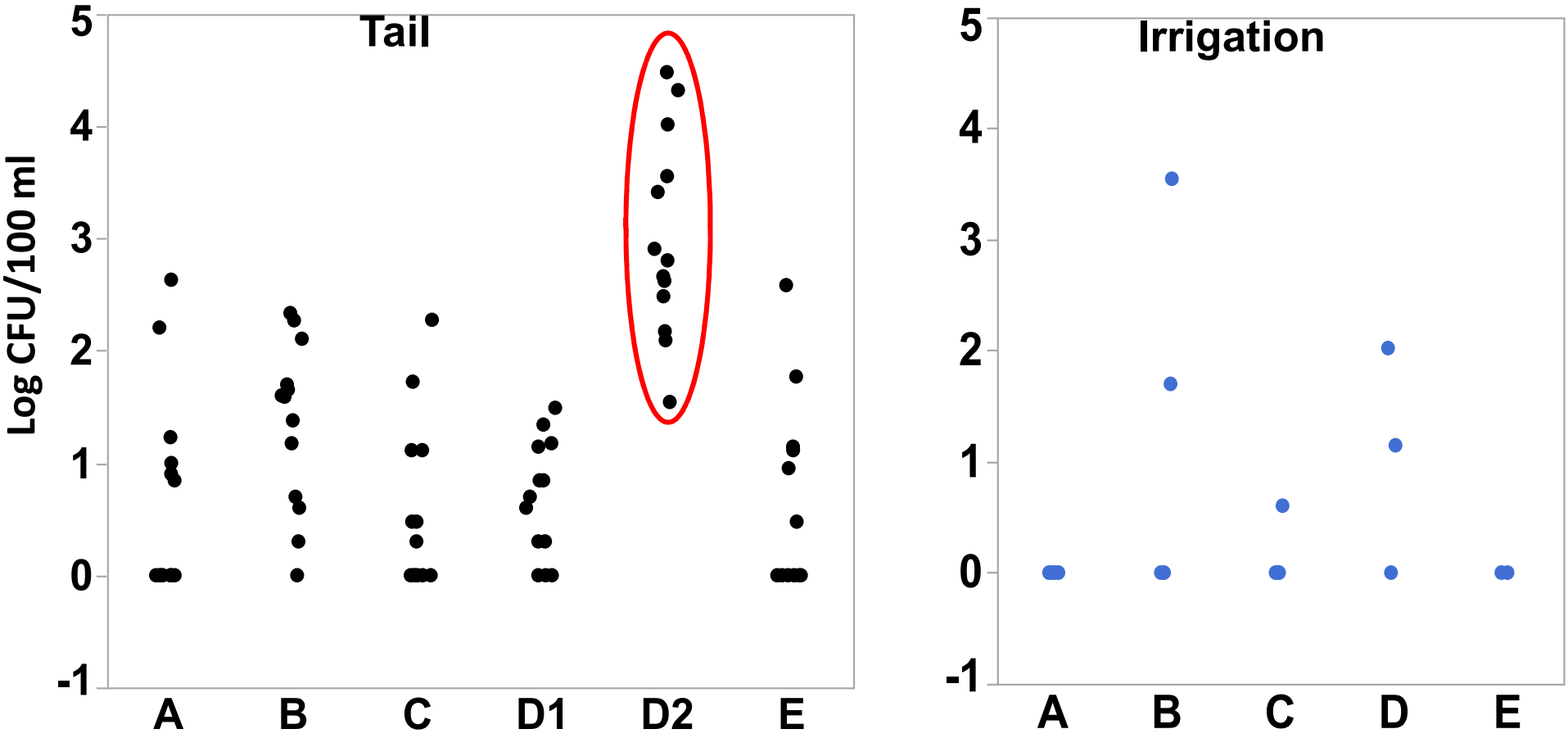


Concentration of generic *E. coli* in tail water

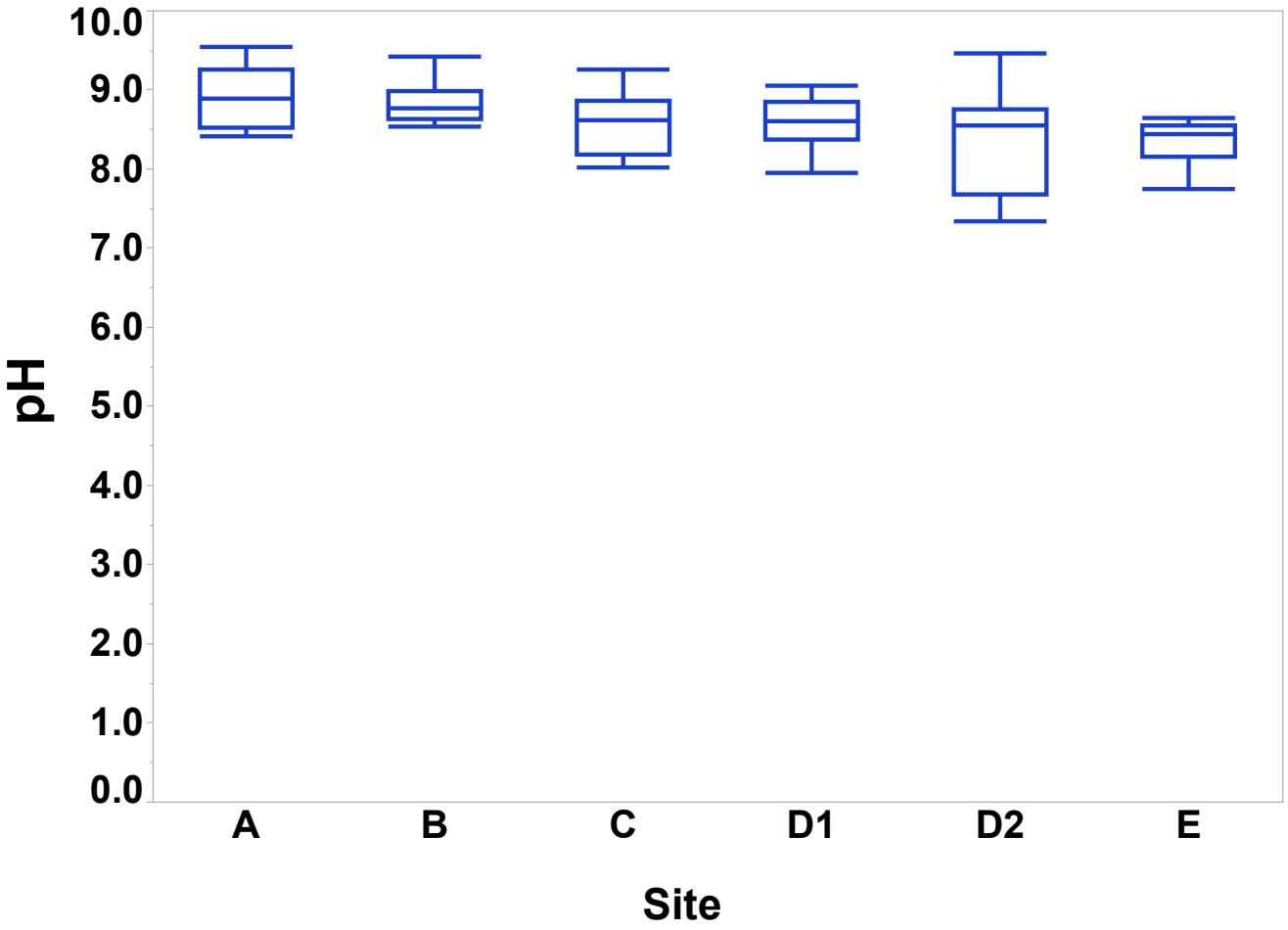




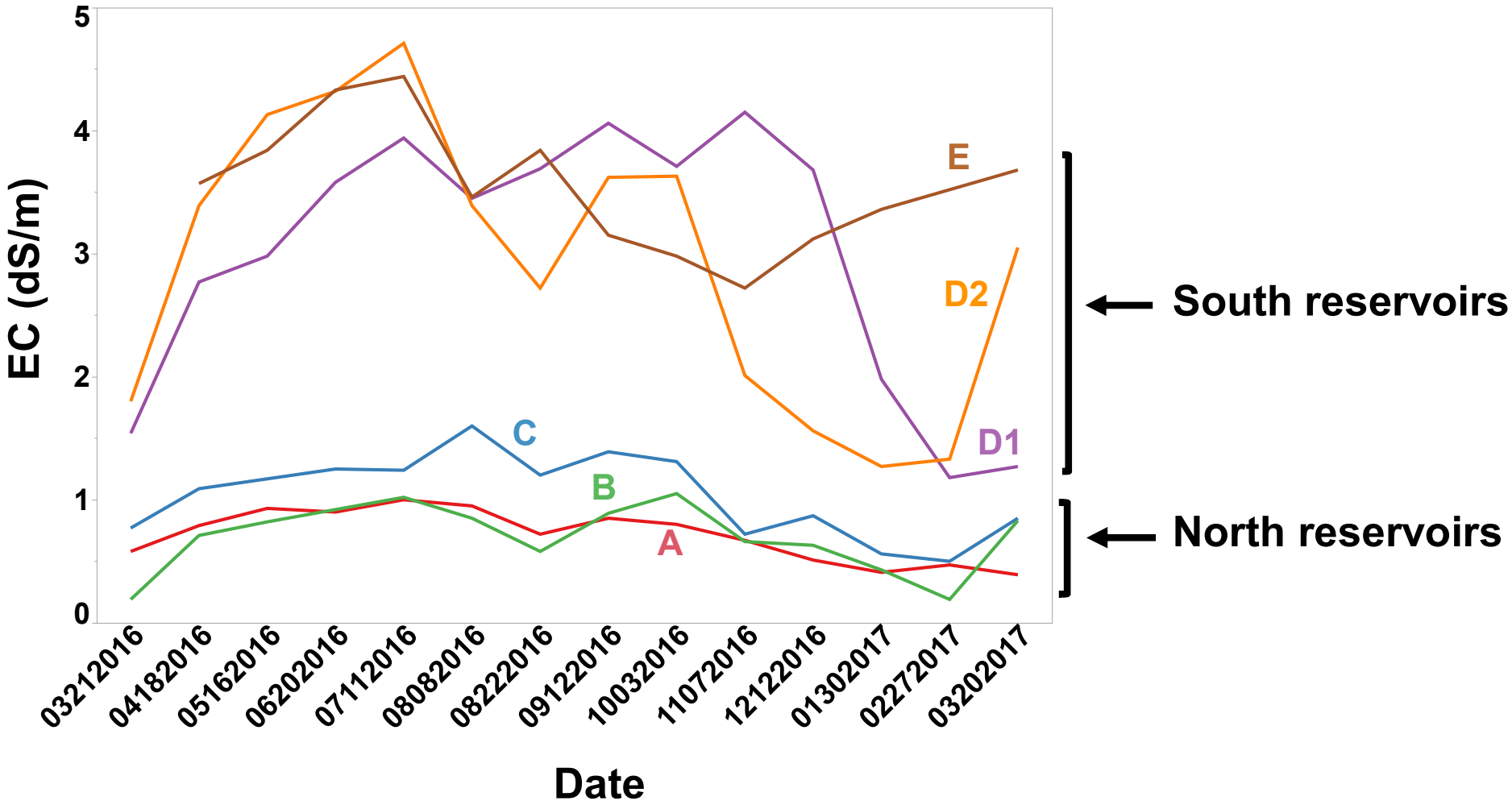
Concentration of generic *E. coli* in tail and irrigation water



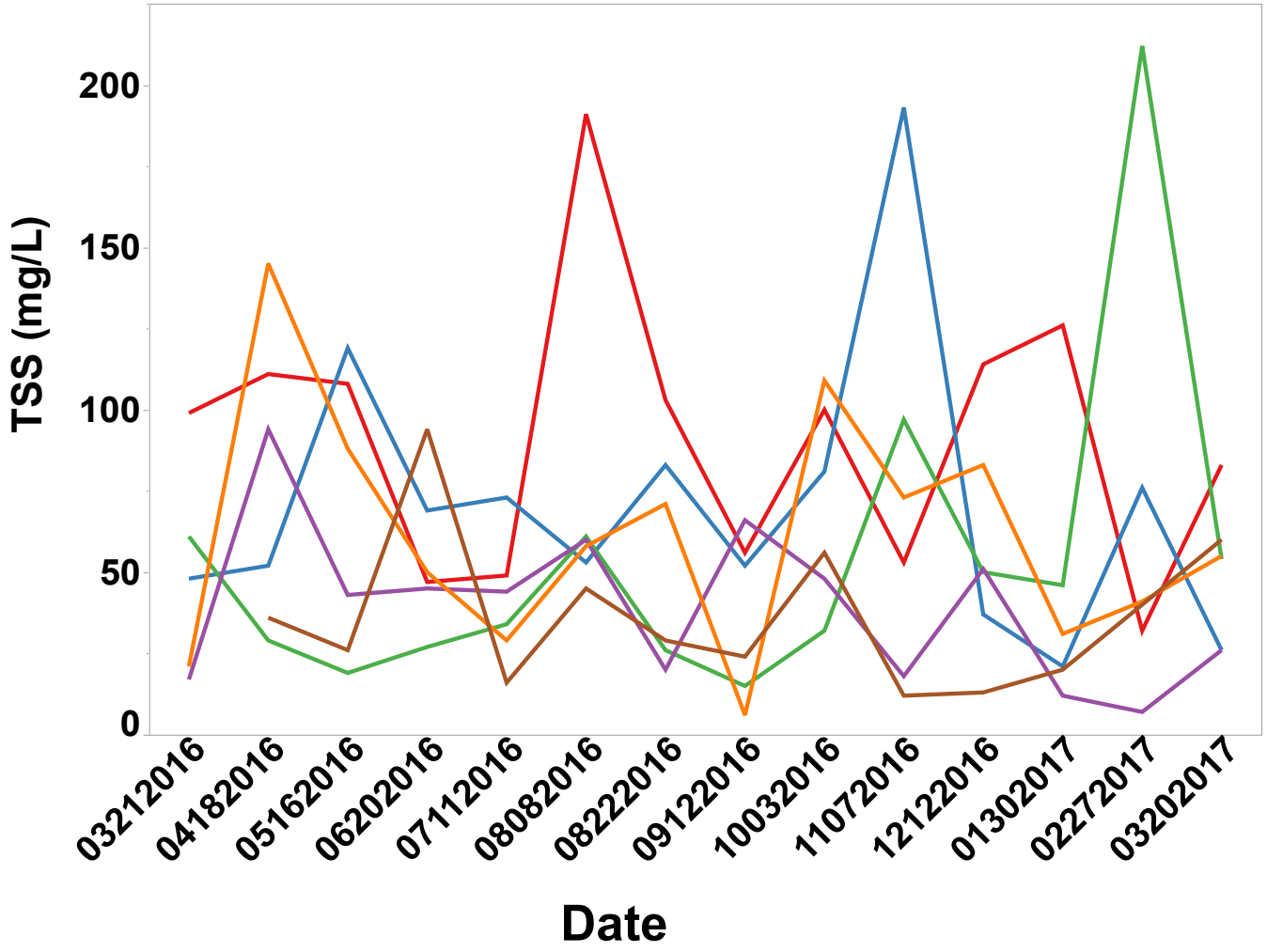
Tail water pH



Salinity of tail water



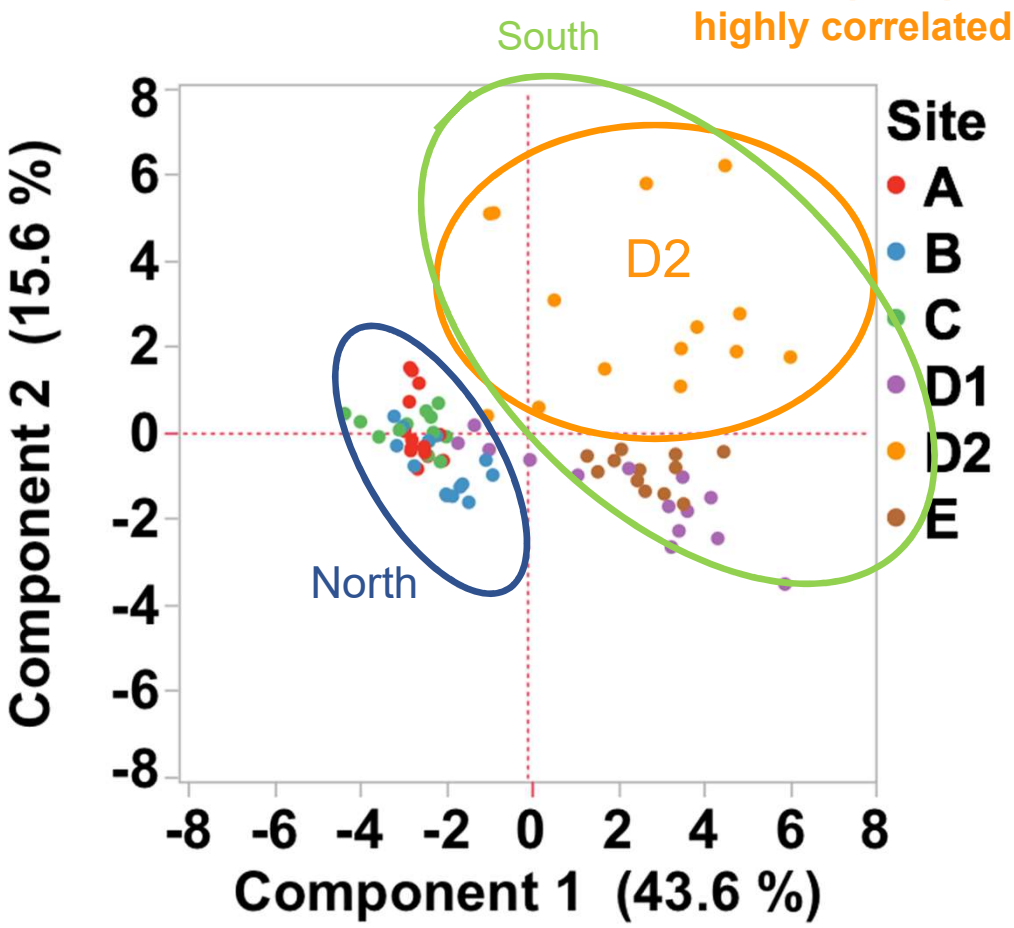
Turbidity and suspended solids of tail water



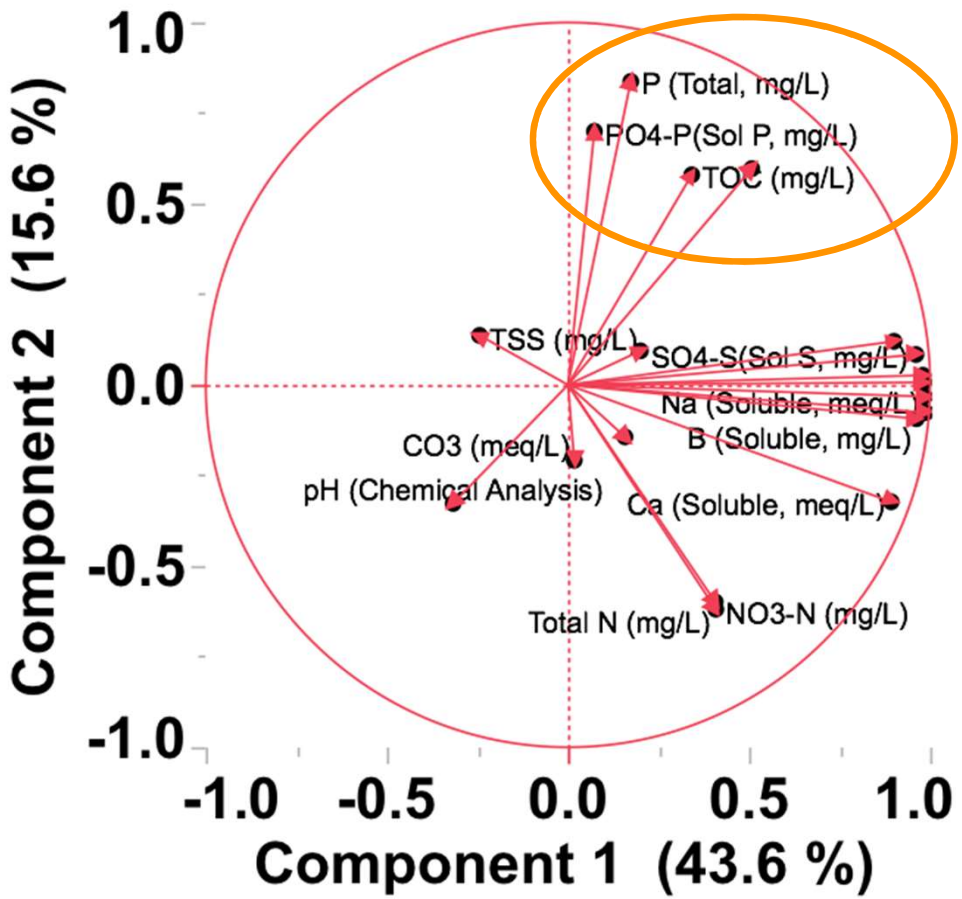
Range 6 to 212 mg/L
Median = 51 mg/L

What physicochemical characteristic is associated with the high concentration of generic *E. coli* in D2?

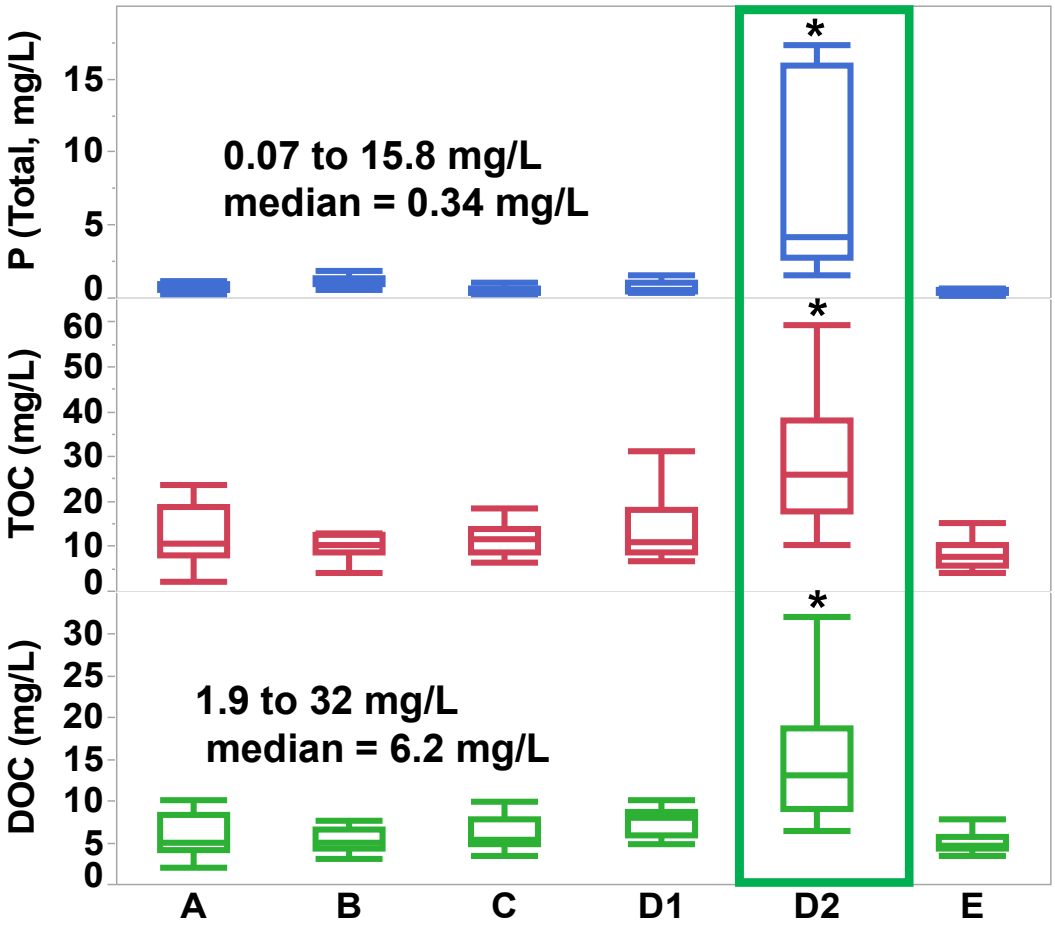
Soluble phosphate concentration (PO_4^-) highly correlated with *E. coli* concentration

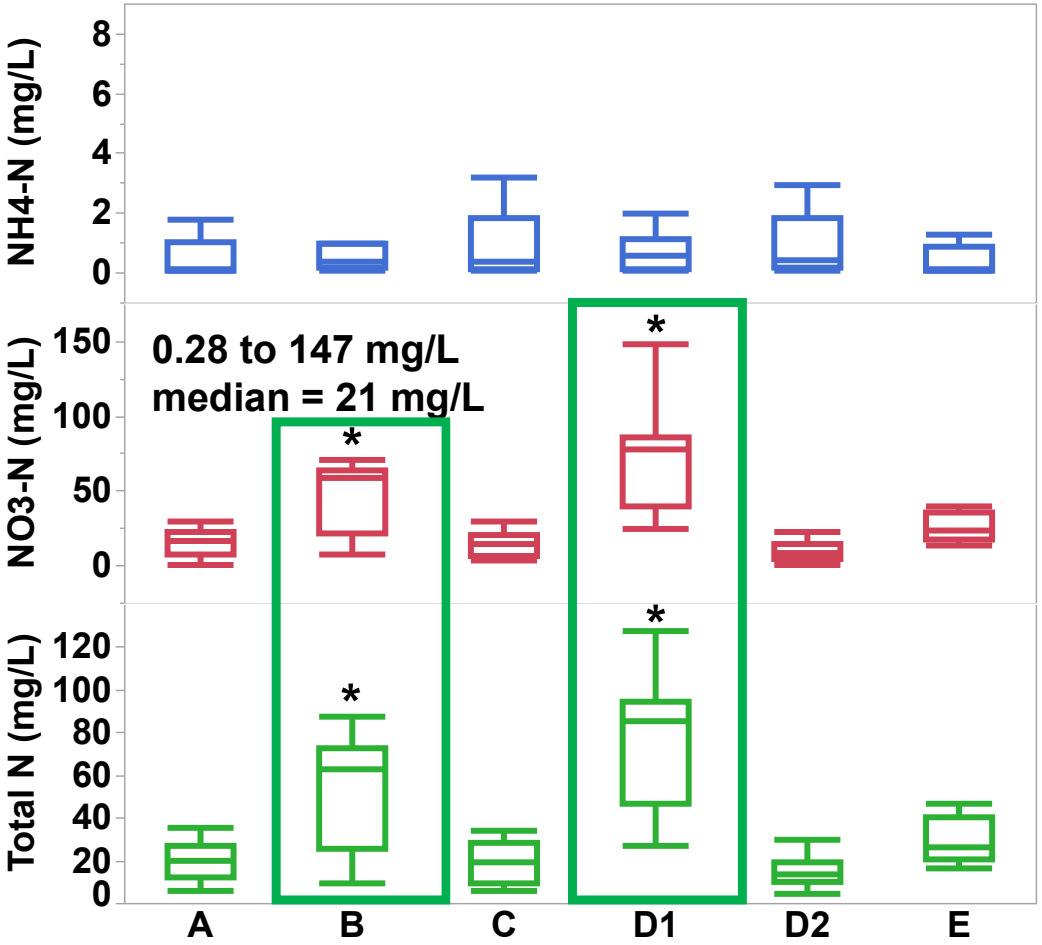


19 variables

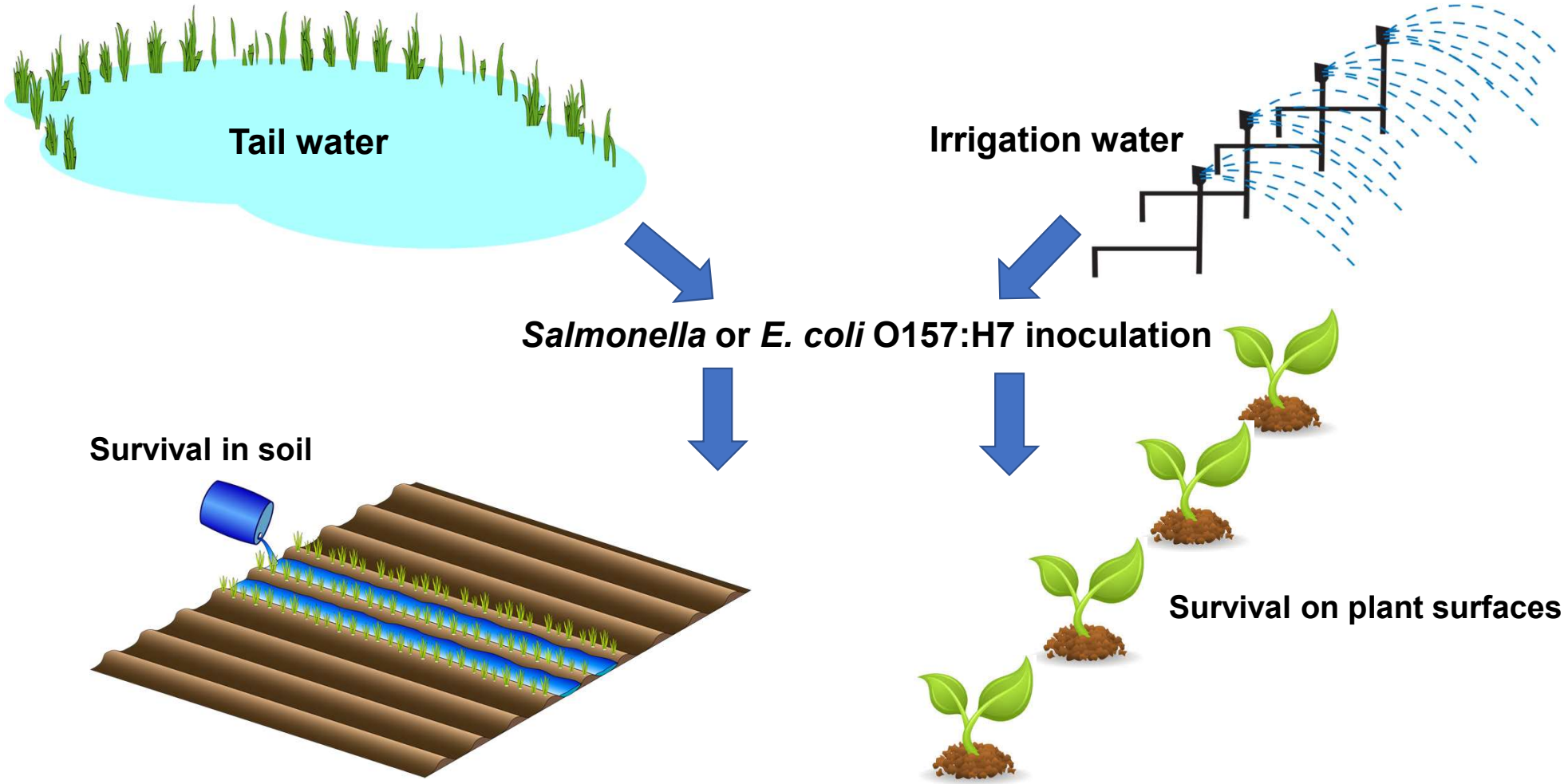


Concentration of phosphate, nitrogen, total and dissolved organic carbon in tail water

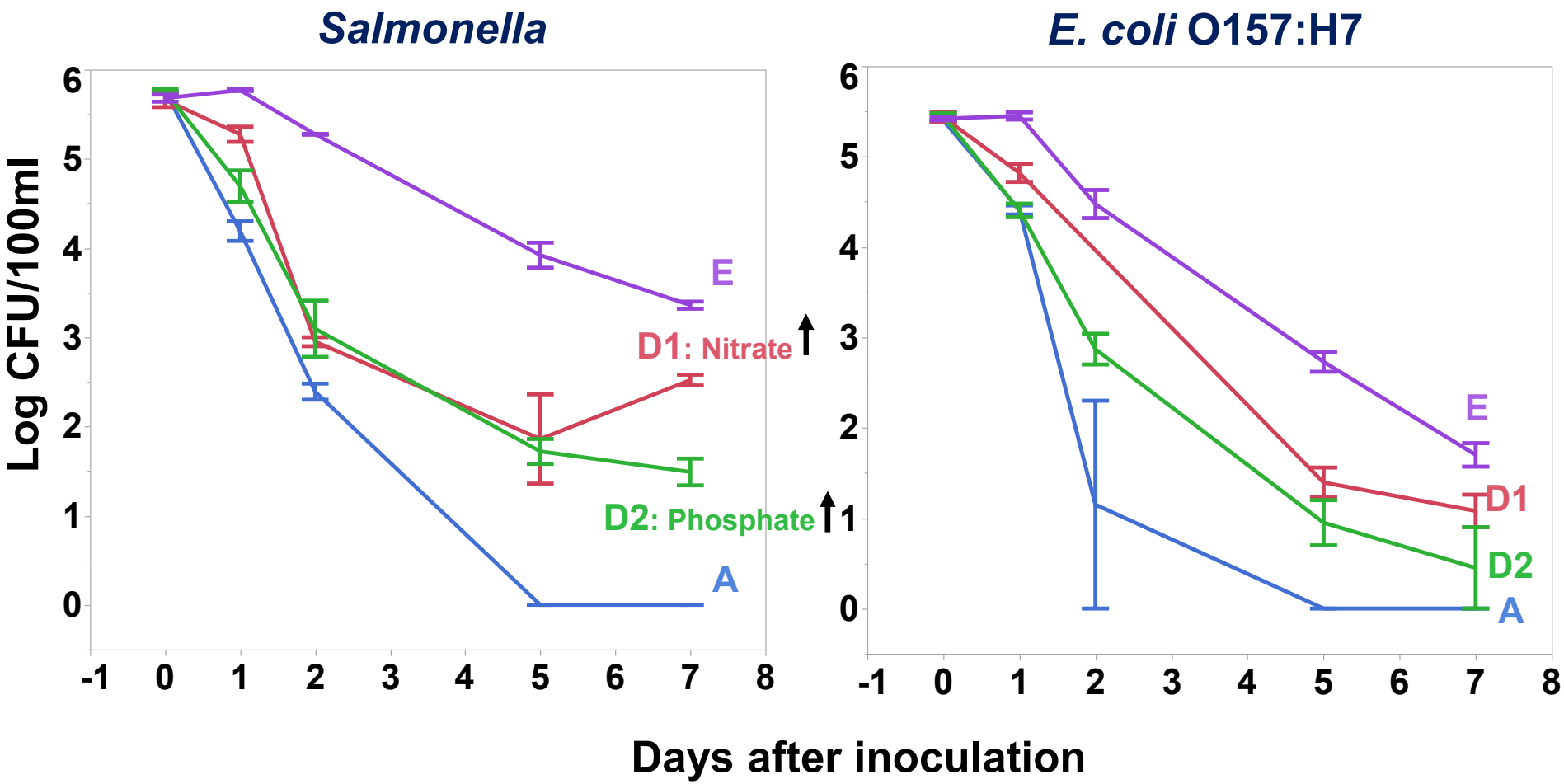




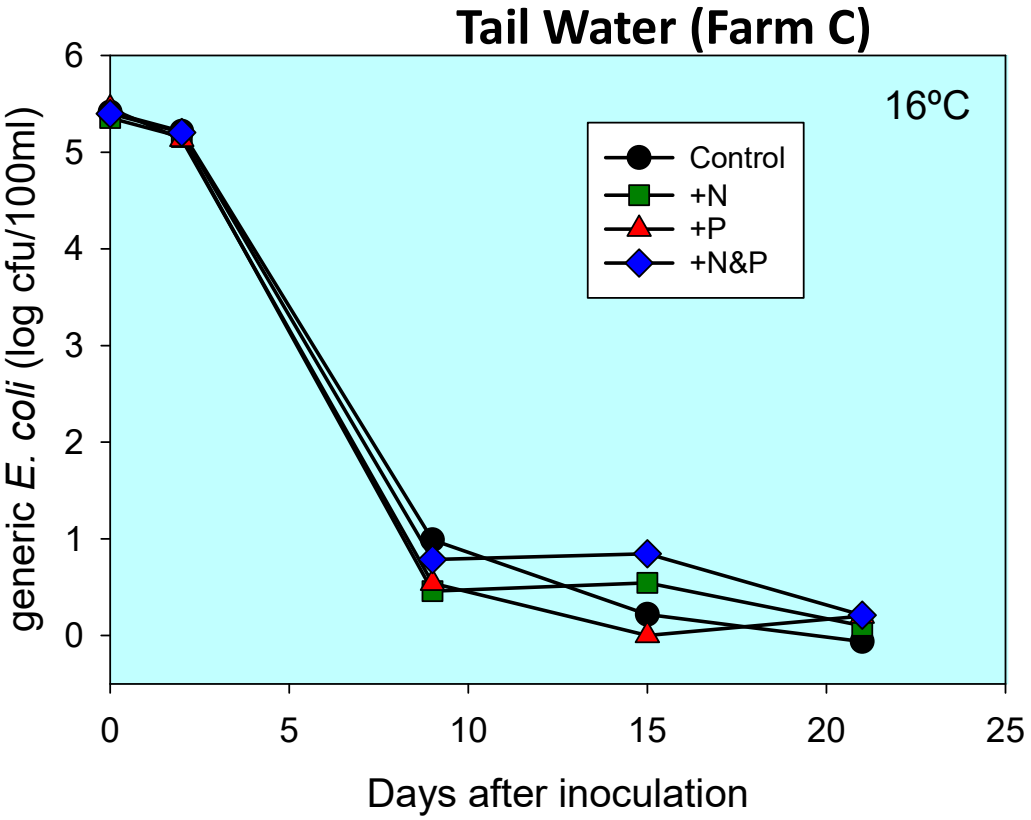
Risks of using tail water in leafy green production

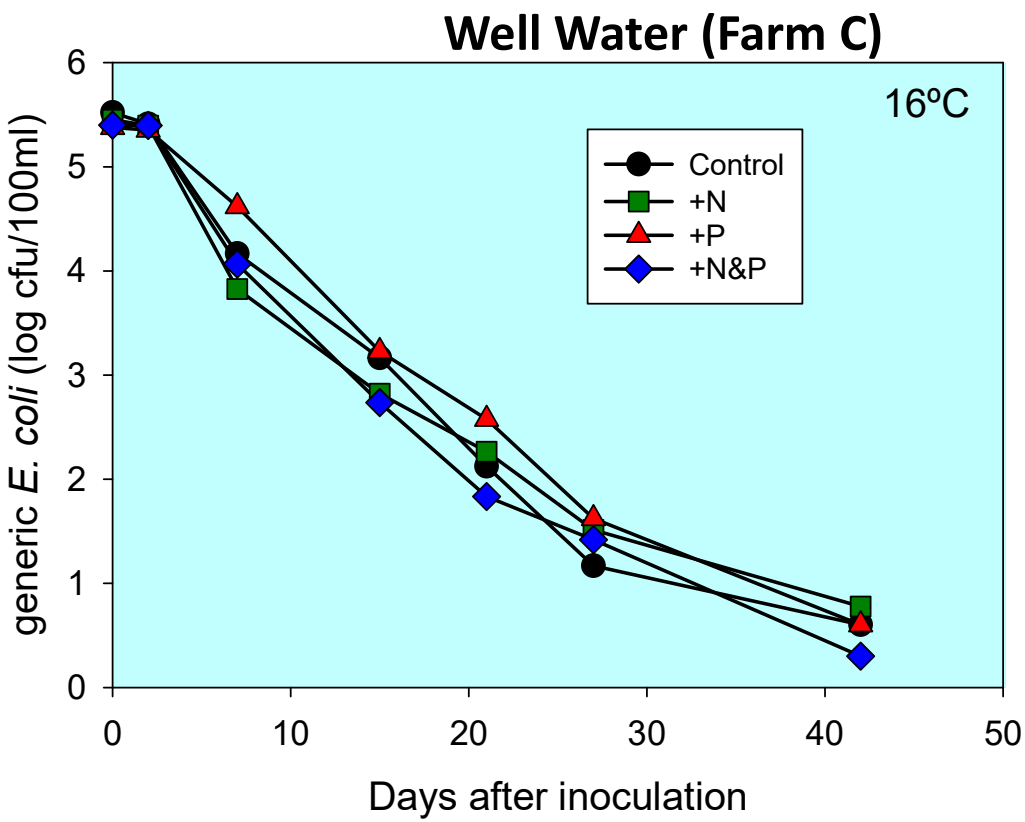


Influence of tail water origin on *Salmonella and E. coli* O157:H7 survival at 19ºC



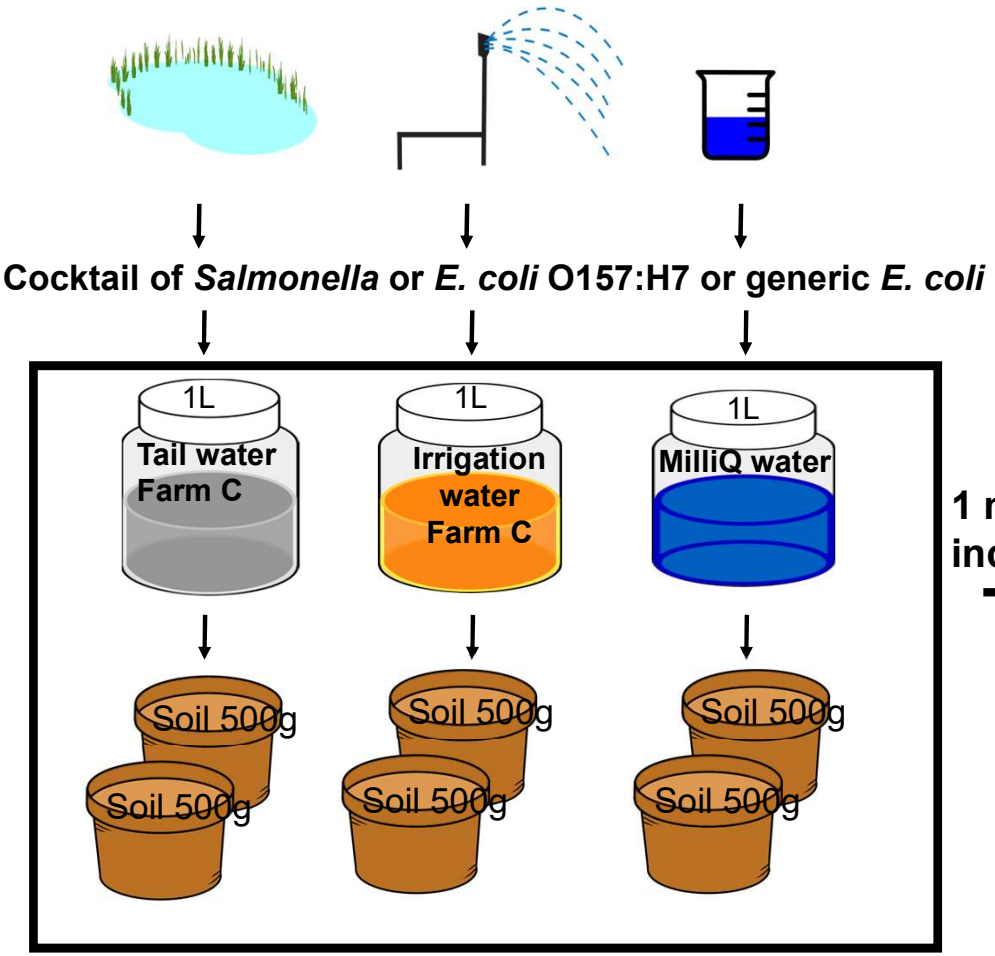
Effect of nutrients on survival of generic *E. coli* in tail and well water





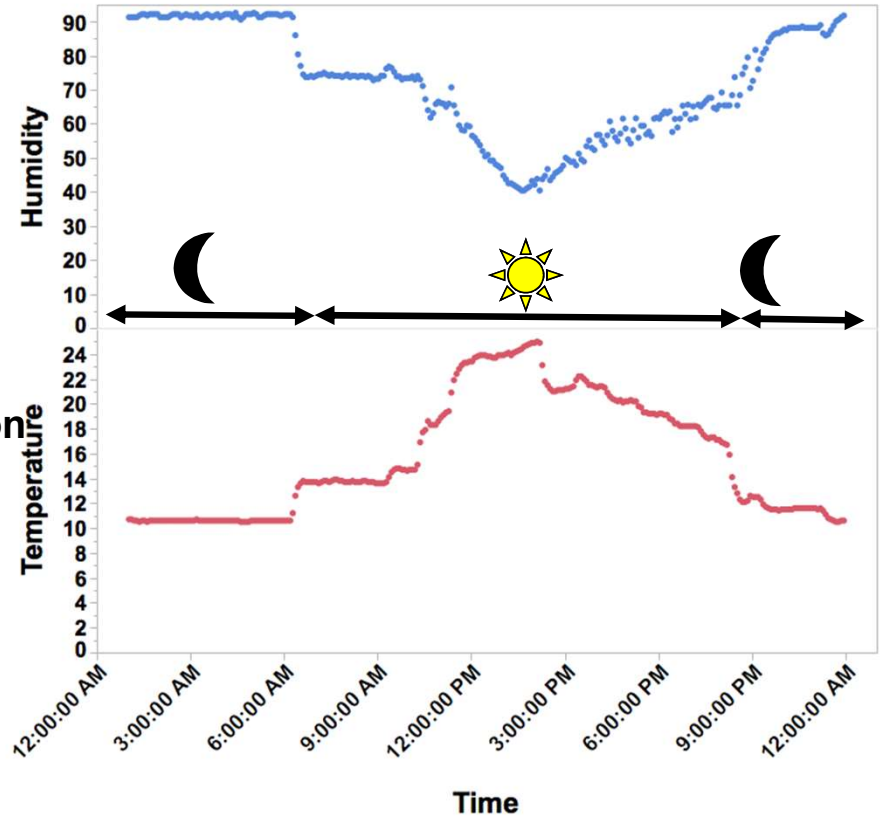
- **Nutrients did not influence the survival of generic *E. coli* in tail water and well water**
- **Generic *E. coli* concentrations decreased faster in tail water than well water**

Inoculation of generic *E. coli*, *E. coli* O157:H7 *and Salmonella* in different water sources and onto soil

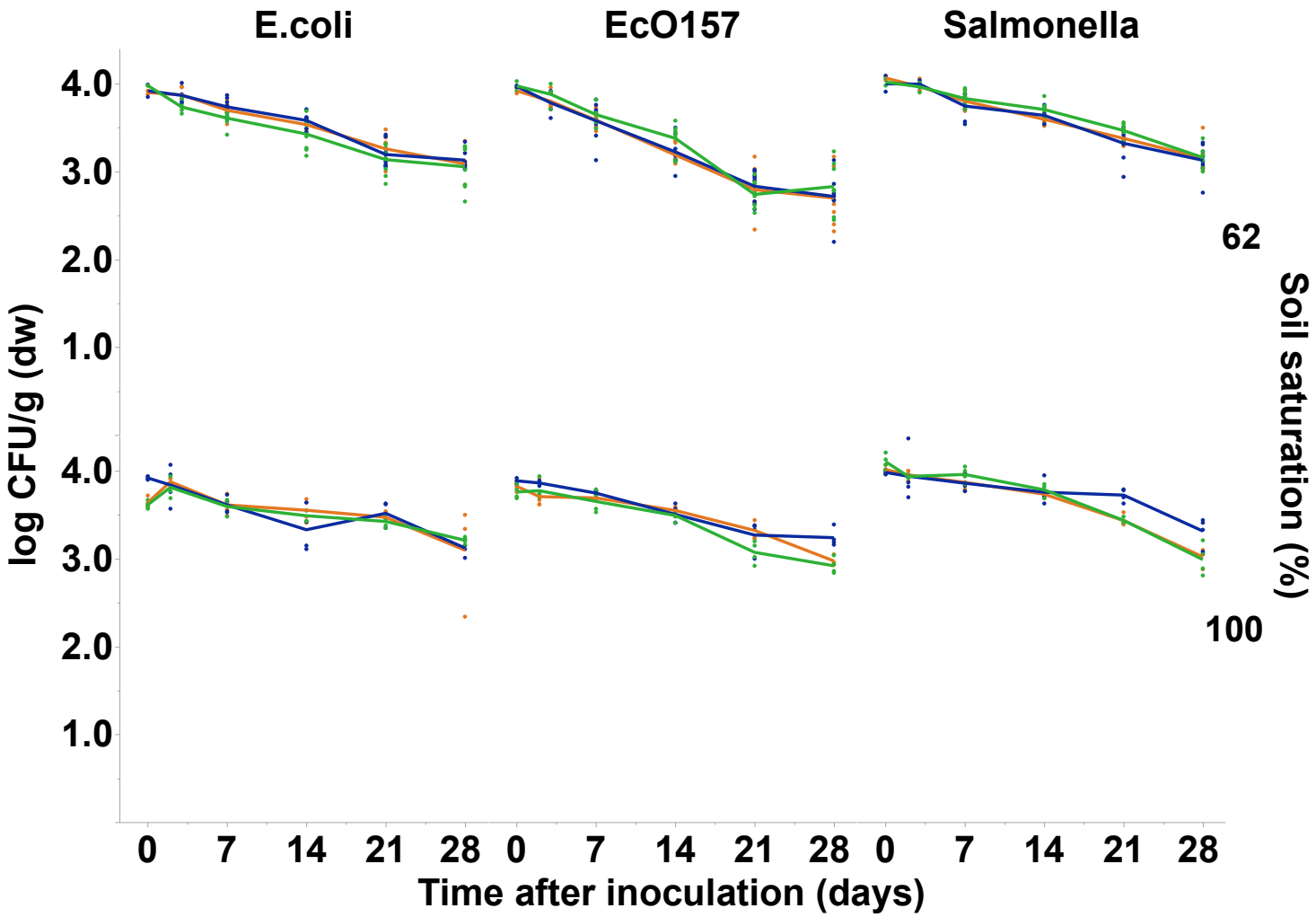


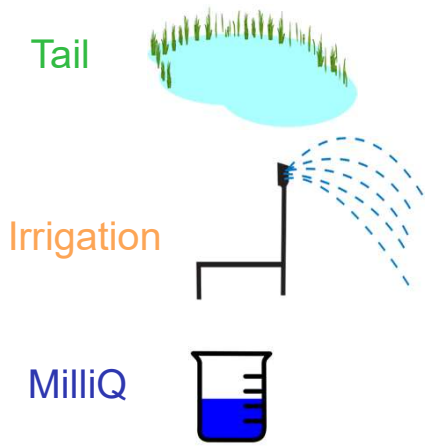
1 month incubation

Humidity and temperature identical to Salinas weather

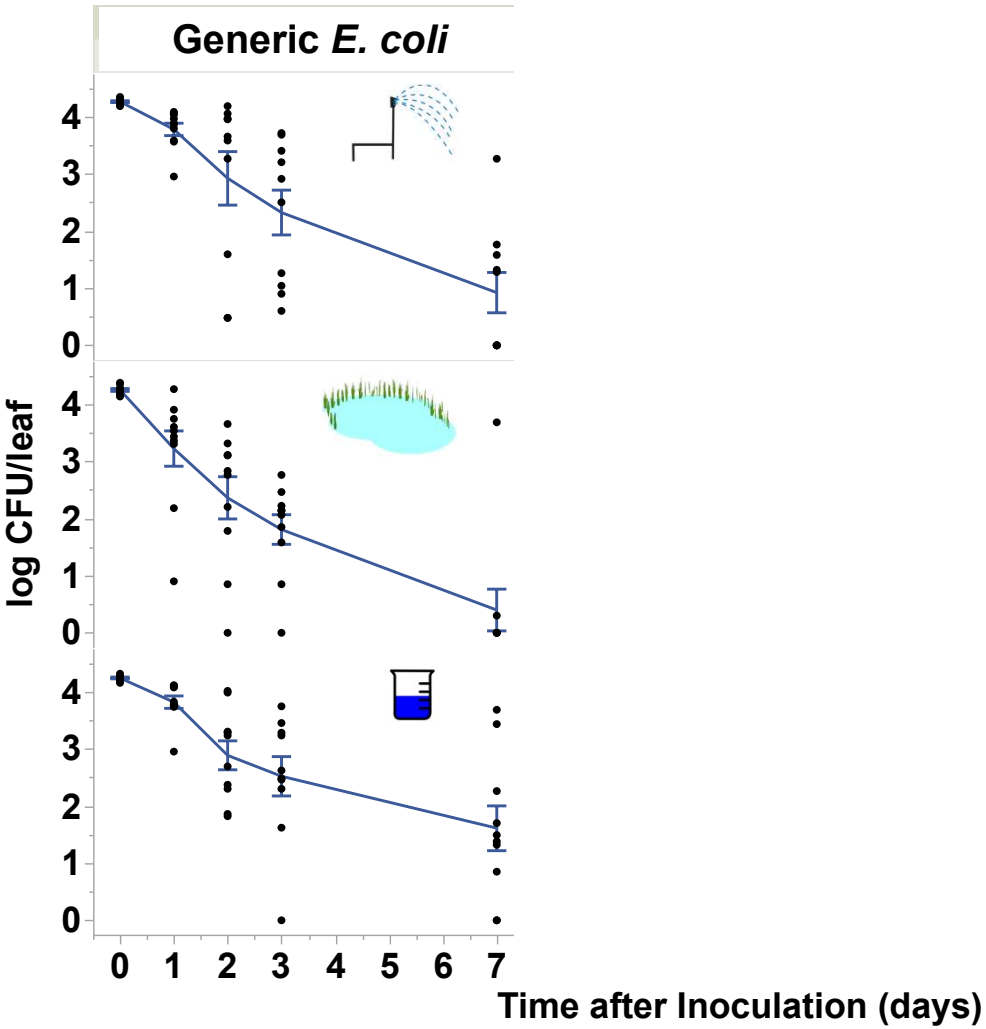


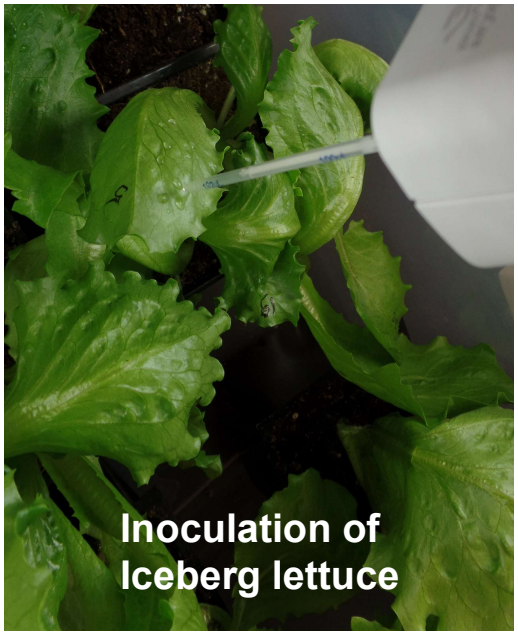
Survival of *E. coli* O157:H7, *Salmonella* and surrogate generic *E. coli* in soil after inoculation with contaminated water from different source





Survival of *E. coli* O157:H7, *Salmonella* and surrogate generic *E. coli* on lettuce leaf after inoculation with contaminated water from different sources





Summary

- *E. coli* concentration was low in five out of six tail water reservoirs.
- Prevalence of *Salmonella* (1.8%; 4/229) and *E. coli* O157 (0.4%; 1/229) was lower than previously reported for the central coast watershed.
- Elevated concentrations of P and N did not increase the survival of *E. coli* in water.
- Tail water did not increase the survival of *Salmonella* or *E. coli* O157:H7 in soil or on growing plants.

Acknowledgments

- Sampling, Coliform and *E. coli* detection

  Ivy Lurz

  Members from Koike's lab

- Pathogen detection, Inoculation studies

  Ethan Morgan

  Members from Harris lab

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CPS CENTER for PRODUCE SAFETY

CALIFORNIA LEAFY GREENS RESEARCH PROGRAM

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