

Strengthening FSMA Agriculture Water Outreach and Education for Produce Growers in Kansas and Missouri

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Award 2019-70020-30358, USDA, NIFA



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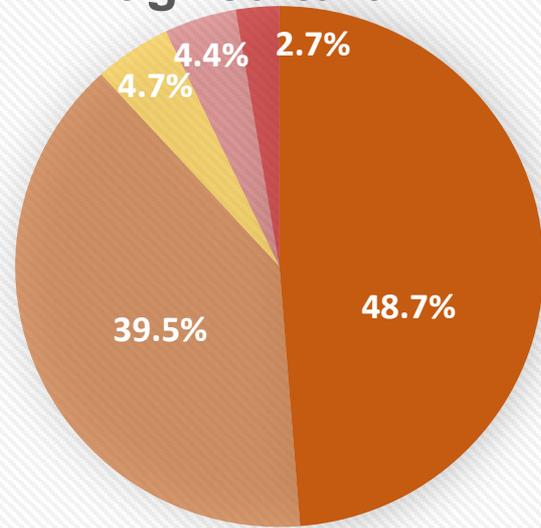
Problem Statement / Issue Definition:

Based on producer water testing conducted in 2016 FSOP

- Some growers had very high E. coli levels in their water
- Limited knowledge of water testing importance
- Needed more training specifically on water

Prevalence of generic *Escherichia coli* in agricultural water

48.7% = MPN <1/100 mL
39.5% = MPN 1-126/100 mL
4.7% = MPN 127-410/100 mL
4.4% = MPN 411-2419.6/100 mL
2.7% = MPN > 2419.6/ 100 mL
N=679 surface, ground, other samples



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Approach / Methods:

1. Develop and administer survey on grower knowledge and practices related to water quality
2. Pilot study- microbial source tracing
3. Demonstration systems on treating surface water for post-harvest use
4. Develop grower training materials on ag water
5. Provide free microbial water testing to MO and KS produce growers



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Results / Outcomes:

Obj 1: Administered survey to 101 Kansas and Missouri produce growers

- Knowledge and current practices related to water quality
- 13.9% of respondents tested their water for generic *E. coli* more than once a year
- 38.6% had never tested their water
- 59.3% said they used municipal water for postharvest uses
- 6.7% use un-treated surface water for postharvest activities
- Results published in *Food Protection Trends* in November 2022

“Knowledge and Current Practices Related to Agricultural Water Microbial Quality among Kansas and Missouri Produce Growers” Yeqi Zhao, Olivia C. Haley, Manreet Bhullar, Don Stoeckel, Londa Nwadike.



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Results / Outcomes:

Obj 2: Pilot study to trace sources of generic *Escherichia coli* found in six ponds and one cistern in Kansas and Missouri used for produce irrigation

- Conducted quarterly sampling for one year
- 99 different serotypes present
- all samples had at least two Antimicrobial Resistant genes
- 4 isolates were Shiga-toxin producing
- 53% of isolates could be traced back to a bovine source of contamination

accepted for publication in Food Protection Trends



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Results / Outcomes:

Obj 3: Established a protocol to validate effectiveness of controlled treatment methods for surface water for post-harvest use

- Peroxyacetic acid (PAA) and chlorine (Cl) evaluated as treatments for simulated surface water
- Simulated surface water: turbidities of 2 and 100 NTU, pH 6.5 or 8.4, 32 or 12 °C, inoculated with 5 logs per mL of generic E. coli, treated with Cl 25 ± 2 ppm, PAA 75 ± 5 ppm
- All Cl and PAA treated samples were below the test limit of detection (<5 CFU/mL), and E. coli was not detected in 5 mL enrichments even at $t = 0$ (shortly after treatment).

Irakoze Z, Nwadike L, Stoeckel D, Bhullar M, Byers P, Gragg SE. "Evaluation of Peroxyacetic Acid and Chlorine as Treatments for Surface Water for Post-Harvest Uses in the Produce Industry." *Water*. 2022; 14(23):3890.



Second study: testing these treatments in rain barrel and pond water- submitted for publication

-Working towards establishing demonstration systems to educate growers on this topic

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Results / Outcomes:

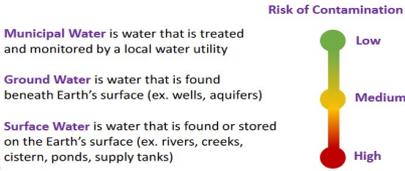
- Obj 4:
- Have developed and continue to develop materials, will translate
 - Help growers better understand the importance of, and the procedures for, monitoring and improving water quality in produce
 - Available from: www.ksre.k-state.edu/foodsafety/produce/index.html

QUICK REFERENCE GUIDE Produce Safety and Agricultural Water Quality

“ The *Food Safety Modernization Act (FSMA) Produce Safety Rule (PSR)* states that all agricultural water *must* be of safe and adequate sanitary quality for its intended use (§112.41) ”

What is Agricultural Water?

Agricultural water is water that is intended or likely to contact the edible portions of produce or food contact surfaces during growing (pre-harvest) or during/after harvest (post-harvest). The PSR outlines three common sources of agricultural water: **ground water**, **surface water**, and **municipal water**.



What's the difference between Pre-harvest and Post-harvest Water?

Pre-harvest Water is any water that is applied directly to produce during growing

- Irrigation
- Crop sprays
- Fertigation
- Frost protection
- Cooling

VS

Post-harvest Water is any water that is used during and after field harvest of the produce

- Field Packing
- Washing
- Hydro-cooling
- Ice making
- Hand Washing

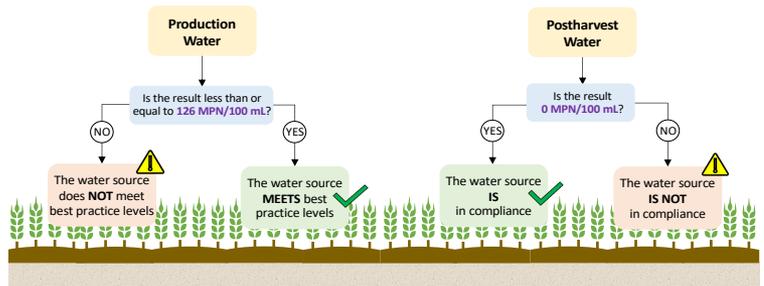
Note: water used for hand washing also counts as postharvest water since it can potentially contact the produce surface.

How do we determine water quality?

QUICK REFERENCE GUIDE How to Interpret Your Water Quality Test Results

Step 1: Determine if the water source meets best practice/ regulation levels

Intended Use:



Step 2: Determine the next steps if the water source **IS NOT** best practices/ FSMA PSR compliant

If the postharvest water is not compliant:

DISCONTINUE use as soon as practical (switch to municipal water or other reliable source) unless corrective measures are applied.



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



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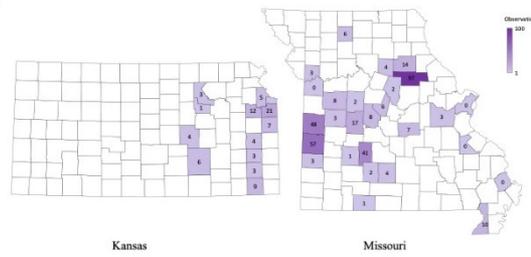
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Results / Outcomes:

Obj 5:

- Continue to provide cost-free water testing to Kansas and Missouri produce growers to enhance understanding of their water quality
- 426 agricultural water samples analyzed using IDEXX Colilert with Quanti-Tray/2000 method.
- Average *E. coli* in surface water sources (158.7 MPN/100 mL, $n = 247$) was statistically greater than groundwater sources (20.4 MPN/100 mL, $n = 179$, $P < 0.0001$)
- Seasonal effects were detected ($P < 0.0001$)



- “Comparative Assessment of the Microbial Quality of Agricultural Water on Kansas and Missouri Fresh Produce Farms” Olivia C. Haley, Yeqi Zhao, Joshua M. Maher, Sara E. Gragg, Valentina Trinetta, Manreet Bhullar, Londa Nwadike. *Food Protection Trends*, vol. 42, no. 3, pp. 186-193, May 2022 Volume 42, Issue 3: Pages 186–193



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