

Assessing the potential for production practices to impact dry bulb onion safety



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Summary

In 2020 and 2021, the dry bulb onion industry faced two significant outbreaks when onions were epidemiologically linked to >2,000 cases of salmonellosis. After review of outbreak data and consultation with stakeholders, we identified water application practices that could contribute to large-scale contamination events late in the growing season. We have designed field trials to characterize the risks of using a contaminated water source when applying crop protection sprays (pesticides and/or clay) and during irrigation (overhead vs. drip). Our goal is to demonstrate risk of these practices and to communicate our findings to relevant stakeholders to reduce the potential for future outbreaks. Our goal is to enable growers to better understand risks and implement changes to minimize the likelihood of crop contamination.

Objectives

1. Quantify *Escherichia coli* contamination rates, die-off, and potential growth in onions due to application of crop protection sprays, including clay application to prevent sunburn.
2. Quantify *E. coli* contamination rates, die-off, and potential growth in onions due to overhead irrigation with contaminated water.

Methods

Field trials in Pasco (Washington) and Ontario (Oregon) were completed in the 2022 growing season to evaluate potential for microbial contamination associated with pre-harvest water applications and field curing. Rifampicin-resistant *E. coli* (TVS353, TVS 354, TVS 355) were inoculated into water used to prepare pesticide or clay preparations (in Oregon) on red (var. Red Wing) and white (var. Cometa) onions or for overhead and drip irrigation (in Washington) on yellow (var. Calibra) onions. Inoculated water and contaminated onions bulbs were analyzed for the presence and quantity of rifampicin-resistant *E. coli* using Most Probable Number (MPN) methodology. Onions (n = 40 per treatment) were analyzed at days 0, 0.25 (OR only), 1, 2, 7, 15-16, and 28-29.

Results to Date

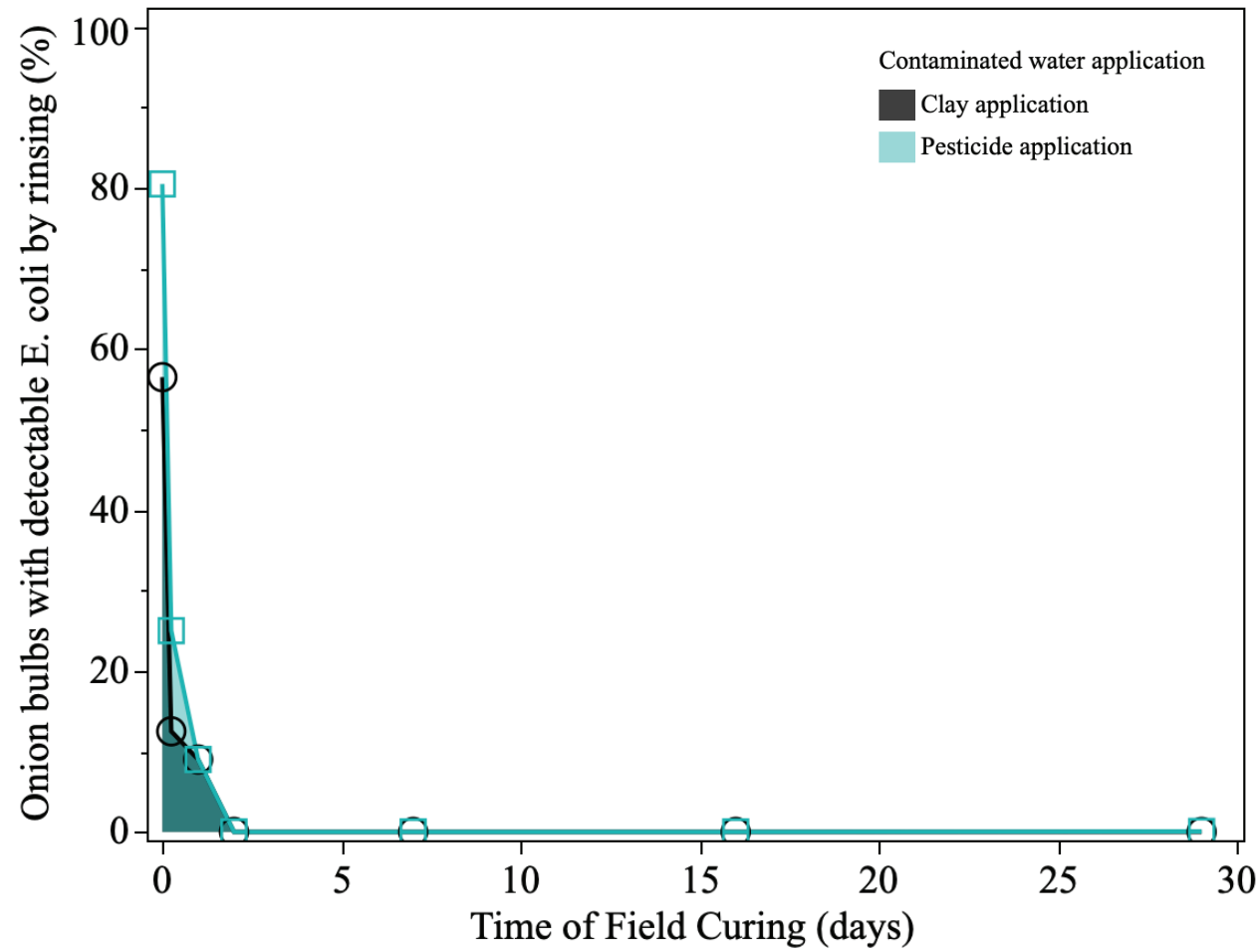
Spray applications delivered 2–4 ml/plant, whereas overhead irrigation delivered 30–65 ml/plant. Water inoculation was 3–4 log CFU/100 ml.

- Prevalence of *E. coli* on onions treated with spray solutions ranged from 21/40 to 35/40 immediately after application. Prevalence decreased steadily over 24 hours, with no detectable *E. coli* on onions from days 2 to 16. At the end of field curing (day 29), a single onion tested positive (1/320).
- Overhead irrigation caused the highest prevalence (38/40) of *E. coli* on onion bulbs immediately after irrigation, which steadily decreased throughout curing. *E. coli* was not detected on onion bulbs (0/80) treated with overhead irrigation water at the end of curing (day 28). *E. coli* was only detected on drip irrigated onions on day 1 (5/40).

Benefits to the Industry

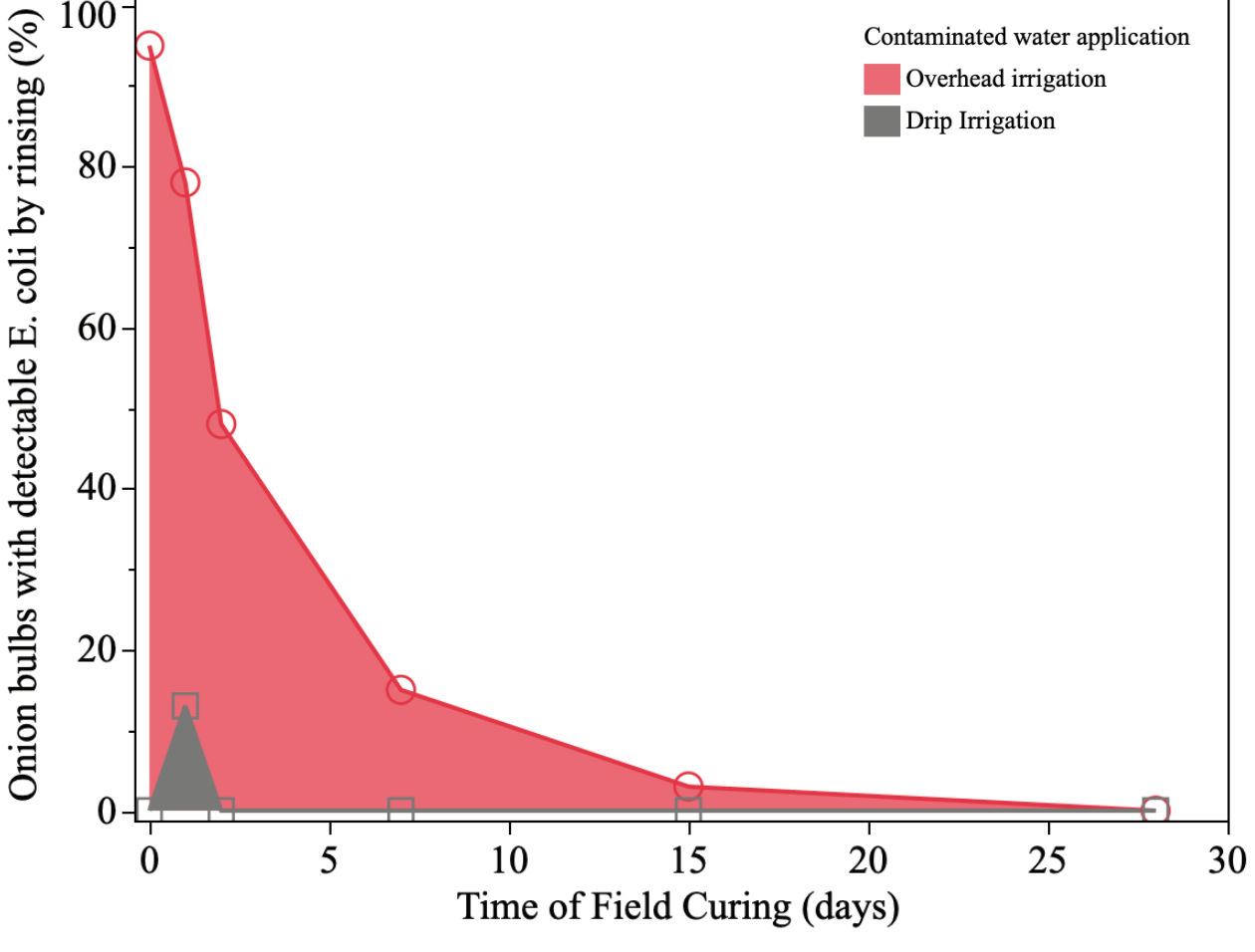
This project is generating evidence of the risks, or lack thereof, associated with important and unique water applications used in dry bulb onion production. Research outputs include prevalence and quantification of *Salmonella* surrogates in field settings to support development of clear guidelines for water quality for these crop applications. These findings will be translated and disseminated to growers for informing decisions in their operation to support proactive and practical changes to practices which will minimize the likelihood of another outbreak. Likewise, practices that do not have any significant impact on *Salmonella* survival may be selected based upon the preferences of the grower. We aim to provide science-based evidence to empower growers to make informed risk mitigation decisions.

2022 Oregon Field Trial Results:
Pesticide vs Clay solutions inoculated with *E. coli*
TVS-353, TVS-354, TVS-355



Water inoculated at ~13,000 CFU/100 ml.
Estimated water application per onion bulb was 2-4 ml.
Estimated average of ~400 CFU applied per plant.

2022 Washington Field Trial Results:
Overhead vs. Drip Irrigation inoculated with *E. coli*
TVS-353, TVS-354, TVS-355



Water inoculated at ~1800 CFU/100 ml. 0.38 acre-inch.
Estimated water application per onion bulb was 30-65 ml.
Estimated average of ~850 CFU applied per plant