Microbial Food Safety Risks of Reusing Tail Water for Leafy Green Production

RESEARCH IN PROCESS

SUMMARY

The use of sprinklers and furrow irrigation frequently results in significant volumes of run-off, also referred to as tail water. Although vegetable growers have made much progress in reducing irrigation run-off by using drip, overhead sprinklers are needed to germinate and establish crops, and to water high-density leafy greens such as spinach and baby greens. Many Central Coast ranches have infrastructure for reusing tail water to irrigate crops, including sediment basins, reservoirs, and pumping systems. Even during the prolonged drought in California, growers were reluctant to irrigate crops with tail water due to a lack of information on microbial food safety risks. The overall goal of this project is to evaluate the food safety risks of using tail water to irrigate leafy green crops using conventional irrigation and production practices. During the first year of the project we are characterizing the chemical and microbial populations in run-off from commercial vegetable farms located in the Salinas Valley.

OBJECTIVES

The objectives of this project are to: 1) characterize and quantify microbial populations in run-off water from Central Coast vegetable fields; 2) evaluate the risk of using this water source for the production of lettuce and other leafy green crops by quantifying survival of microorganisms during simulated reuse applications; and 3) evaluate economically feasible methods to treat tail water that would minimize microbial food safety risks for a range of reuse applications (e.g., pre-irrigation, dust control, irrigation).

METHODS

Grab samples of tail water were collected monthly from retention ponds at commercial farms (Figure 1) and processed as described in Figure 2. Moore swabs were also placed in tail-water ponds for 72 hours. Tail-water samples were evaluated using standard plate count methods for aerobic plate count, and generic *Escherichia coli* and coliforms were determined with the Colilert Quantitray 2000 following the manufacturer's instructions. Moore swabs were incubated in 250 ml TSB for 2 h at 25°C with 100 rpm shaking, followed by incubation at 42°C for 8 h. Five 1-ml aliquots of the enrichment were frozen in 15% glycerol and kept at -80°C until further processing. *Salmonella* and *E. coli* O157 will be detected by real-time PCR and plating of the enrichment. Water temperature, pH, oxidation-reduction potential (ORP) and conductivity were measured in situ with a YSI Professional Plus multiparameter meter. Turbidity and nutrients (N, P, dissolved C) will be measured by standard laboratory procedures.

Figure 1. Collecting grab samples

RESULTS TO DATE

Five farms were identified that represent the geography and range of weather regimes and soil types of the Salinas Valley (Figure 3). Sampling sites were established in 6 tail-water retention basins. Samples of irrigation water for crops irrigated with well water (4 sites) and tail water(2 sites) are also being collected at monthly intervals. Preliminary results indicated a wide range of generic *E. coli* concentrations in tail-water pond samples (<1 to 140 MPN/100 ml). Coliform bacteria concentrations ranged from untreated tail-water ponds ranged from 135 to >24,196 MPN/100 ml. Electrical conductivity ranged from 0.8 to 3.5 dS/m. Surface water temperatures of tail-water ponds ranged from 15 to 23°C. Presence of human pathogenic microbes will be determined from the enriched and frozen samples collected from the Moore swabs at the end of the season.

BENEFITS TO THE INDUSTRY

The anticipated benefits of this project to the vegetable industry are a better understanding of the food safety risks of irrigating crops with tail water. This project will determine the range of chemical and physical properties and bacterial populations that are typical in tail water used for commercial lettuce and leafy green farming operations. Additionally, we expect to better understand the food safety risks of using tail water for leafy green and lettuce production by conducting controlled trials that simulate irrigations with tail water, and identify potential strategies for minimizing these potential risks. Potential impacts for the produce industry are data that improve the LGMA metrics and guidelines for using irrigation run-off or reclaimed water. Specifically, success will mean identifying factors that impact microbial populations in run-off water from coastal vegetable farms, as well as characteristics of tail water that influence persistence of foodborne pathogens in leafy green fields that receive run-off water.

Figure 2. Sample processing

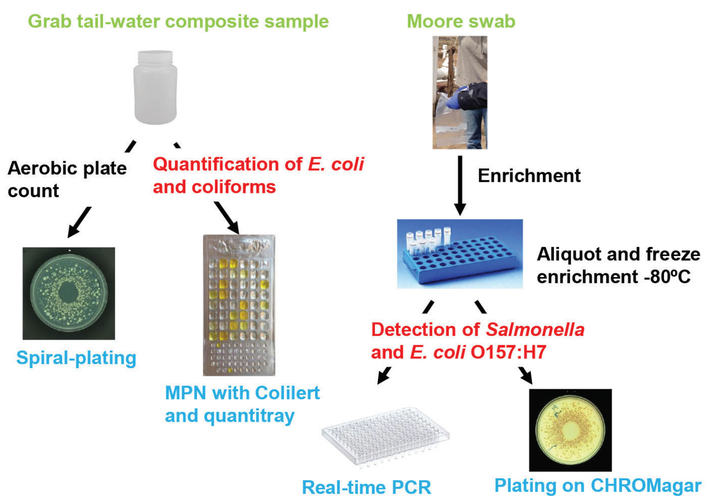
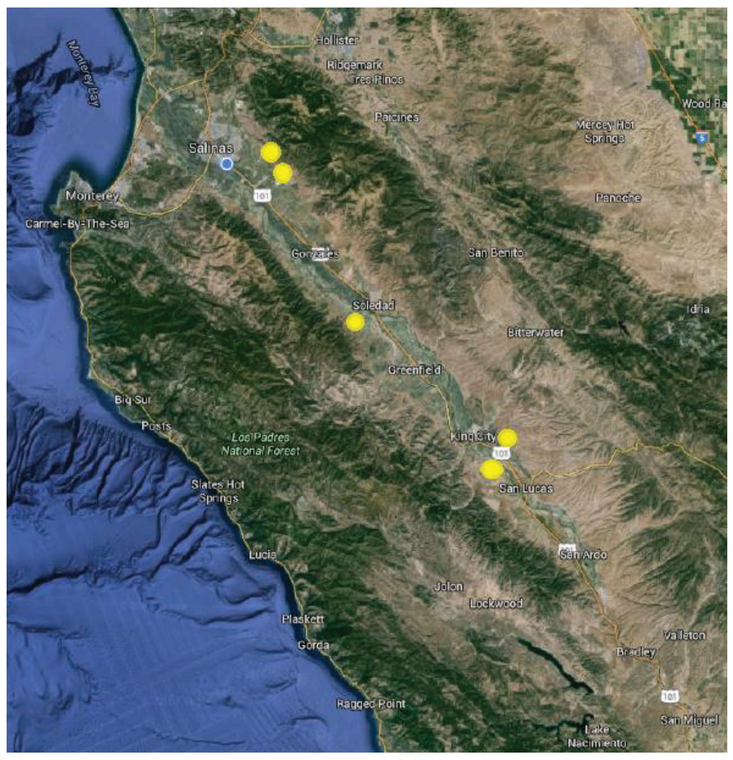
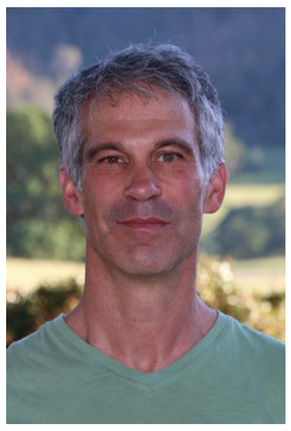


Figure 3. Yellow circles indicate area of sampling sites within the Salinas Valley.





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ACKNOWLEDGEMENTS

Funding for this project is from the Center for Produce Safety and the California Leafy Green Research Board.

LENGTH OF FUNDING

January 1, 2016 – December 31, 2017

CENTER for PRODUCE SAFETY