

Methods for determining groundwater under the influence of surface water and BMPs for mitigating distribution system contamination

Summary

This project addresses a critical knowledge gap in microbial issues in fresh produce irrigation sources and distribution systems. Our project collaborates with growers in Arizona, California, Florida, and Georgia to identify groundwater wells that may be under the influence of surface water. The research and Extension team will use innovative microbiological sampling techniques coupled with historical records review to assess groundwater source vulnerability. In the second phase, the research and Extension team will evaluate interventions like pipe flushing, shock chlorination, and water treatment to establish effective mitigation measures for acute and chronic irrigation pipe distribution system contamination. Success will be measured by industry adoption of our recommended sampling strategies and Best Management Practices for remediation of distribution system contamination.

Objectives

1. Identify ten groundwater wells that are suspected as being under the influence of surface water in four produce growing regions of the U.S. including AZ, CA, FL, and GA; evaluate wells using various alternative water sampling methodologies (100 mL vs 1L vs 100 L) and parameters at least 2 times each over the course of year 1.
2. Using water quality data collected in year one, in addition to intensive grower records review, the research team will identify trends, correlations and recommended monitoring strategies for industry to use to effectively evaluate surface water and groundwater connectivity.
3. Using model irrigation system pipe-loop distribution systems, evaluate industry BMPs for mitigation of acute/chronic distribution system contamination.

Methods

In collaboration with growers in Arizona, California, Florida, and Georgia, the first phase of this project involves identifying groundwater wells under the influence of surface water, using innovative sampling techniques (e.g., 100 L sample volumes) and assessing both traditional and non-traditional parameters, including generic *Escherichia coli*, Total Coliform bacteria, bacteriophage, protozoa, and microscopic particulate analysis. This comprehensive monitoring, coupled with records review, will guide the industry on suitable sampling methods to detect surface water influence on groundwater.

The second phase of this project entails constructing irrigation distribution system pipe-loops in three locations to assess impacts of atmospheric and water quality conditions on water quality degradation (**Figures 1 and 2**). Upon biofilm establishment, interventions—pipe flushing, pipe shocking using sodium hypochlorite, and routine water treatment—will be evaluated for efficacy.

Results to Date

The project team has identified groundwater wells that are suspected to be under the influence of surface water in Arizona, California, Florida, and Georgia (see example – **Figure 3**). Additionally, the team has included two wells in Indiana for inclusion in the study. Standard operating procedures (SOPs) for water sampling have been shared across the three research teams, and staff have been trained in large-volume sampling methods to ensure results comparability (Objective 1). Sampling of wells has been initiated in three produce growing regions and records have been requested of participating growers. The project PI has also worked with a third-party laboratory to establish shared research sample submission plans for the participating laboratories and reporting structure in anticipation of sampling to continue in the next quarter.

Benefits to the Industry

This project aims to provide guidance to industry on the general process and field sampling methodology for determining hydraulic connectivity and acute/chronic distribution system contamination through water quality monitoring and boots-on-the-ground assessment in addition to suggested Best Management Practices to manage contamination.



Figure 1: Cross section of aluminum pipe used for irrigation of fresh produce with surface water over one season showing substantial biofilm development and/or sediment accumulation.

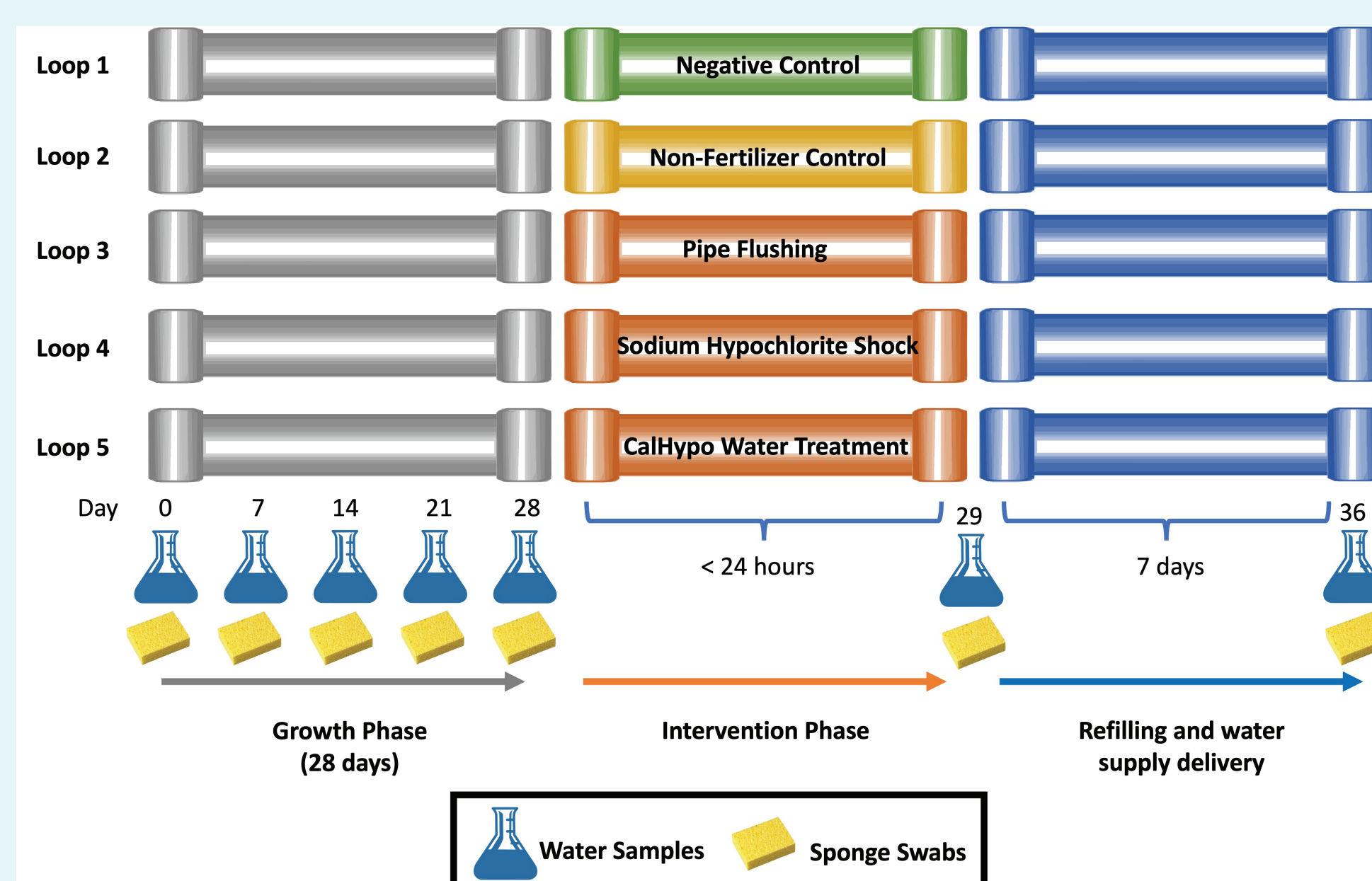
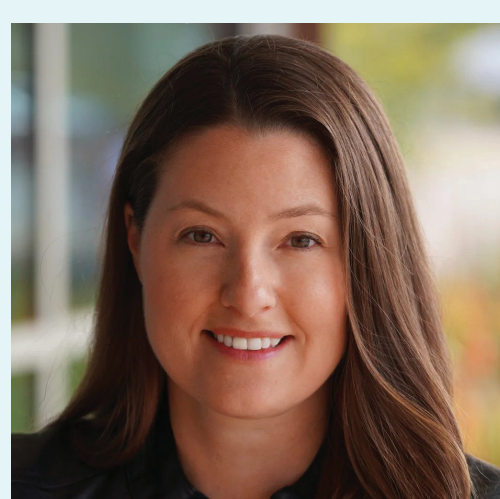


Figure 2: Pipe loop sampling schematic



Figure 3: Groundwater well suspected of being under the influence of surface water



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