

Internalization of *Salmonella* Typhimurium in Hydroponically Grown Mung Bean Sprouts

Author: Susan Rymut

Project Advisor: Jiyoung Lee

Purpose: Mung bean sprouts, a popular item typically found in Asian cuisine, are consumed raw or minimally cooked and are often at high risk for containing foodborne pathogens such as *Salmonella*. Most previous studies about bean sprouts were focused on contaminated seeds and the fate of pathogens. However, if irrigation water contains pathogens, there is a chance for the pathogen to contaminate the sprout. Internalized pathogens especially pose high risk since conventional sanitization is ineffective to inactivate them. The goal of this study is to understand the potential of internalization of *Salmonella* in mung bean sprouts with the presence of the bacteria in irrigation water. Our hypothesis is that the extent of *Salmonella* internalization is associated with the level of contamination in water.

Research Methods: Mung bean sprouts were grown hydroponically and were given GFP-tagged *Salmonella* Typhimurium (ca. 10^9 CFU/ml) after germination through maturity. One set received the contaminated water daily for five days while the other five sets received contaminated water only one of the five days. Samples were harvested daily and their surfaces were disinfected using ethanol and AgNO_3 . Internalized *S. Typhimurium* was counted using LB agar with 0.1% ampicillin. Green fluorescent colonies were counted after incubating for ~24 hrs at 37°C.

Findings: The internalization of *Salmonella* was observed in all contamination events at the level of 2.0-5.1 log CFU/g sprout. Continuous watering with contaminated water during the entire period generated statistically higher levels of *Salmonella* internalization than those five sets that received contaminated water only for a single day ($p < 0.05$).

Implications: The presence of *Salmonella* in water is subject for the bean sprouts to become internalized with the pathogen at high enough levels to result in illness if ingested. Therefore, proper procedures in regards to using and maintaining clean water must be followed throughout the bean sprouts production chain.