

Lettuce Industry Research Agenda

In December 2005, the California Lettuce Research Board, Salinas CA, and invited guests met to develop a list of food safety research needs related to lettuce production, harvesting and post-harvest handling. The identified items were summarized as follows:

- I. **Introduction of *E. coli* O157:H7 into the environment where fresh and fresh-cut lettuce is grown, harvested, and undergoes postharvest handling.**
 - Feces-containing soil amendments – The frequency and amount of *E. coli* O157:H7 introduced into the environment by use of such soil amendments. (How much risk is involved with this practice?) Factors affecting environmental loading by this risk factor: adequacy of and compliance with composting procedures; manure applications scheduling during various phases of the growing cycle.
 - Animals (domestic and wild) – The frequency of animal carriage and deposition of *E. coli* O157:H7 introduced into the environment by this risk factor. Factors affecting environmental loading, frequency of in-field droppings during various phases of the growing cycle.
 - People (latrines, “visitors”) – The frequency of *E. coli* O157:H7 carriage by produce handlers and visitors and the potential for introduction into the environment during various phases of the growing and harvesting cycle. Factors affecting environmental loading events (i.e. contamination events).
 - Equipment (tractors, trucks, pipes) – The frequency and amount of *E. coli* O157:H7 into the environment by such pieces of equipment. Factors affecting environmental loading, off-field; frequency and timing of potential in-field contamination events during various phases of the growing and harvest cycle.
 - Water (flooding, irrigation) – The frequency and amount of *E. coli* O157:H7 introduced into the environment by water sources prior to and during various phases of the growing and harvest cycle. Factors affecting environmental loading by this risk factor; prevalence and levels of *E. coli* O157:H7 contamination of source water.

- II. **Persistence and survival of *E. coli* O157:H7 in the environment during growing, harvest, postharvest handling and/or processing of fresh and fresh-cut lettuce.**
 - The effects of environmental factors (e.g. time, temperature, RH, UV index, manure type, soil type, soil moisture, contamination levels, etc) and the interaction with production cultural practices (soil incorporation, irrigation, timing of incorporation, etc.) on the persistence and survival of *E. coli* O157:H7 in soil during various phases of the growing and harvest cycle.
 - Persistence and survival of *E. coli* O157:H7 on food contact and non food contact surfaces in production, harvest (equipment, knives, bins, tarps, biofilms), postharvest (cooling operations, packaging materials) and fresh-cut operations.
 - Efficacy of and compliance with cleaning and sanitizing procedures for production, harvest (equipment, knives, gloves, re-used product containers, biofilms) and postharvest (cooling operations, packaging materials) food contact and non food contact surfaces.

- III. **Mechanism of transference of *E. coli* O157:H7 to fresh and fresh-cut lettuce edible plant surfaces during growing, harvest, postharvest handling and processing operations.**
 - Adjacent land use (water or soil movement, animal manure, slues and drainage, public access) and environment effects (insects, wind and water as vectors) – How close is too close and what factors affect transference?

- Food contact surface transference (harvest, postharvest, fresh-cut) of *E. coli* O157:H7 to lettuce – Frequency and levels of exposure to *E. coli* O157:H7; potential for attachment of *E. coli* O157:H7 prior to washing.
- Transference by placing uncut and/or cut product in direct contact with soil contaminated with *E. coli* O157:H7. – Frequency, levels and potential for attachment of *E. coli* O157:H7 prior to washing.
- Microbial transference by water during production (tailwater, splashing during irrigation), harvest (field cleaned and cored) and postharvest operations (cooling) – Frequency, levels and potential for attachment of *E. coli* O157:H7.
- People (personnel practices) – Frequency of *E. coli* O157:H7 carriage by produce handlers; adequacy of and compliance with GAPs during growing, harvest, postharvest and GMPs during fresh-cut operations.
- Direct fecal contamination by animals during growing and postharvest – Frequency and levels of exposure to *E. coli* O157:H7; efficacy of trimming and washing procedures to remove contamination.
- Vacuum cooling effects on microbe infiltration of *E. coli* O157:H7.

IV. Persistence and survival of *E. coli* O157:H7 on lettuce during growing, harvest, postharvest handling, processing and/or end-user handling.

- Effect of *E. coli* O157:H7 source (e.g., direct manure or contaminated water, hand or utensil contact) and timing of contamination (time before washing) on attachment properties (formation of biofilms).
- Efficacy of trimming, washing to remove *E. coli* O157:H7 during processing (as affected by source, location of contamination and attachment of *E. coli* O157:H7 on lettuce).
- Survival and growth of *E. coli* O157:H7 on cut surfaces versus uncut surfaces during growth, postharvest and processing – effects of environmental conditions (RH/surface moisture, temperature, time of contamination prior to washing).
- Shelf-life extending technologies (cold storage, MAP) effects on survival and persistence of *E. coli* O157:H7 which may allow for growth from undetectable levels to disease causing levels.
- How important is temperature control for safety (TCS) for RAC and fresh-cut lettuce products (especially with multiple produce and non-produce component products)
- Efficacy of end-user rewashing for removal of human pathogens.
- Impact of opened packaged product and re-use (temp changes, atmosphere changes, re-contamination, etc.) on *E. coli* O157:H7 survival/growth.