Fresh Tomato Food Safety Research Needs

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Fresh Produce Food Safety

- Pathogen control can occur by 3 methods: prevention of contamination, control of growth, and/or elimination
- Fresh produce (including tomatoes) are “fresh”. An effective kill step (elimination) is not currently available for most fresh produce
- The pathogens of concern (*E. coli* O157:H7, *Salmonella*, viruses) do not need to grow on produce to cause illness, so control of growth is not sufficient
- Must be by prevention of contamination

Prevention

- The weakest form of pathogen hazard control
- Must be controlled throughout the supply chain, from field to fork, applied to 100% of product, 100% of the time
- Must understand the sources, mechanisms of transference, mechanisms of persistence, and mechanisms of prevention
- While there has been considerable speculations on these, in most produce-linked outbreaks we don’t know how contamination occurred
- It’s difficult to fix what we don’t know is broken. But waiting for causes is no longer an option

Good Agricultural Practices

- The 1998 FDA GAPs and subsequent commodity specific food safety guidelines outline the best thinking on potential sources of contamination and their prevention
- Necessarily vague to allow for regional and specific commodity flexibility
- There is no indication that, properly applied, these guidelines are insufficient to ensure fresh produce food safety
- So, are ongoing outbreaks a result of noncompliance or lack of knowledge?

Lettuce Guidelines, ver. 2

Currently in draft, leafy greens technical experts are developing metrics with which to better communicate what “compliance” means

- Water used for irrigation, direct product contact
- Soil amendments and crop treatments
- Flooding, feral animal intrusion
- Adjacent land activities (animal operations, compost storage, wetlands, homes)

Outlines how far, how often, how many

Includes recordkeeping and verification activities

Irrigation Water (draft criteria)

- Test Organism: generic *E. coli*
- Sampling Procedure: 100 mL collected at POU
- Sampling Frequency: Not less than 24 hr apart, not more than monthly
- Test Method: BAM or other accredited for quantitative monitoring of *E. coli* in water
- Acceptance criteria per 100 mL:
  - ≤126 MPN rolling geometric mean, n=5 AND
  - ≤235* MPN on any single sample

    *≤576 MPN for drip or furrow
- Records kept and available for review for 2 years

So what's the problem?

- Some research that generic *E. coli* is a poor indicator of pathogen contamination in water
- No research relating numbers of *E. coli* to risk
- No research that proposed test frequency is adequate
- No research on what to do with produce if contamination occurs
- No research on what to do with field if contamination occurs

Research Approach

- Brainstorm
- Initial culling of unnecessary research
- Culling of (sufficient) research already done
- Prioritization of most potential impact to least
- Clear communication of specific research needs

Expert Solicitation – Hazard Analysis

- Talked with growers, handlers – what are all of the steps, from seed to harvest and delivery?
  - The exceptions are most important
- Where is contamination possible?
  Where is it reasonably likely to occur if not controlled?
- What controls are available to prevent likely opportunities for contamination? Are they sufficient?
- Any “I don’t know” is a potential research question

Prior use of fields

- Most fields in Salinas used for lettuce have been in vegetable production over 70 years
- How many are new? What is “new”? What is the impact of prior use? What prior uses will impact use? Fringe ground. How long is long enough to exceed life cycle of pathogen? What affects length of life cycle in field: nutrients? Does depth of contamination affect longevity of pathogen in field? Does topography affect risk: water flow, animals? How do differences in growing ecology affect all of these factors? If a contamination event is suspected, what remedial actions/timeframes are appropriate? Persistence, as a function of contamination level, soil types, other environmental factors, presence of plant rhizospheres, timing in growth cycle?

Primary Leafy Greens Research Questions

- **Introduction** of *E. coli* O157:H7 into the environment (during production, harvest, post-harvest handling)
- **Persistence and survival** in the environment
- **Mechanism of transference** to edible portions
- **Persistence and survival** on edible portions

Culling of known research

- Don’t waste limited resources by repeating research already done well
- Western Institute for Food Safety and Security commissioned comprehensive literature survey of *E. coli* O157:H7 and leafy greens
- Searchable database available to help focus research needs
- Combine expert solicitation with literature review to focus, prioritize research needs

Top Research Needs for Leafy Greens

Elimination

1. Reliable “kill step” during processing

Top Research Needs for Leafy Greens

Prevention

1. 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.

Top Research Needs for Leafy Greens

Prevention

2. 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.

Top Research Needs for Leafy Greens

Prevention

3. 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.

Top Research Needs for Leafy Greens

Prevention

4. 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?

Be Aware

No reason to believe that solving these research needs will prevent future outbreaks, but

Until these are under control, the industry will continue to be suspected, criticized, vilified whenever an outbreak may be linked to produce

Research Caveats

- Must be based on today's actual agricultural and processing practices
- Must be focused on "solving" the problem
- Must be consistent with market realities: consumers, costs
- Field solutions must be validated in the field

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Questions?