Root Cause Analysis Case Study

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This case study was provided to the Romaine Task Force to illustrate how a root cause analysis can be conducted.

When an issue, food safety or otherwise, occurs, it's not uncommon that several things "went wrong" resulting in the issue. A "root cause analysis" is a systematic, detailed process that is conducted in to reveal the underlying reasons that a problem arose, so that a recurrence can be prevented. Pew convened groups of experts to discuss the process and drafted the findings into a comprehensive report.

The purpose of this case study is to demonstrate how the principles of root cause analysis can be put into practice to investigate an issue related to fresh produce. Although this case study uses avocados as an example, this case study is intended for growers and processors of any fresh produce item. Readers are encouraged to focus on the thought process used to investigate an issue, as opposed to a specific commodity, details of the situation, or "answer".

"The Problem":

As a result of an FDA sampling assignment, the same facility recalled avocados due to the presence of *Salmonella* twice within the same season.

The Approach:

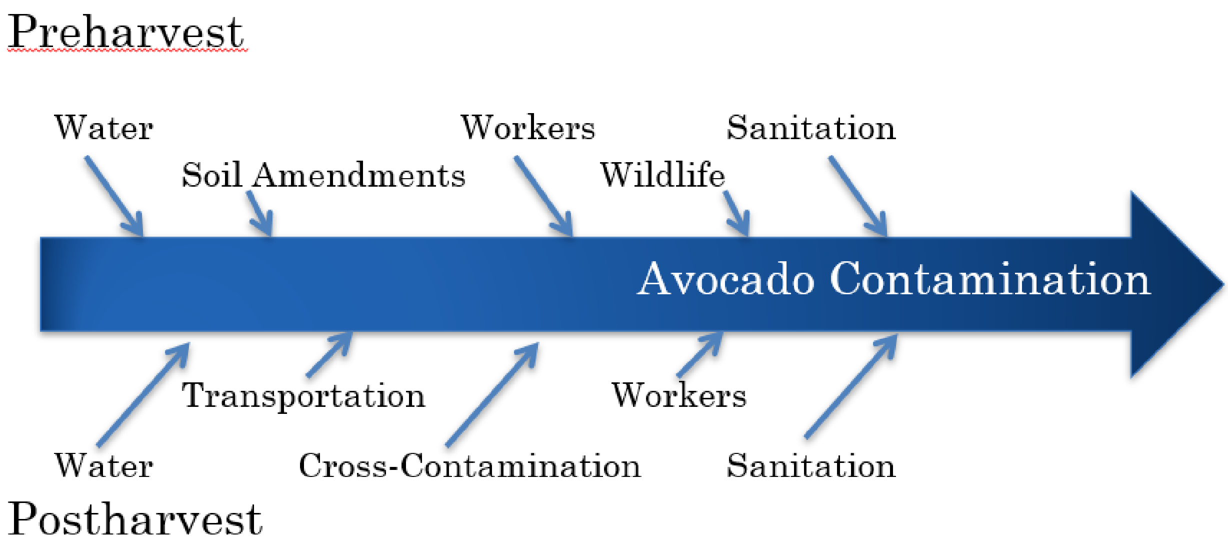
A research team with extensive on-farm experience was invited to the facility to try to determine the root cause of repeat contamination.

About the Team:

Conducting a root cause analysis is facilitated by having a team of individuals with different backgrounds and expertise look at the same situation, ask different questions, and build on each other's questions. There is no right number of people to involve on the team; it should be big enough to cover all necessary specialties, but not so big as that communication becomes difficult. When considering who should be on the team, consider both people very familiar with the commodity, production system, and packing, but also consider bringing in outside support not familiar with the organization, commodity, and production system, which may offer fresh eyes and new perspectives. If you plan to collect samples, the team should include a food microbiologist with laboratory expertise and experience in environmental sampling. There is no set formula for conducting a root cause analysis; there is no universal or "cookie cutter" checklist to use, so the experience of the team and their creativity, imagination, and openness to new ideas is critical to a successful root cause analysis.

The Evaluation Process:

This team used the "fishbone diagram" to visually depict the pre and postharvest inputs into avocado production. An example graphic is shown below. While these general items are applicable to a variety of fresh produce situations, an important part of the analysis is thinking about "what else" could play a role or "what have we changed or are doing differently" and should be thoroughly evaluated. Again, the illustration is not meant to serve as a checklist, although the same key starting risk-points have served the industry since the first Good Agricultural Practices document was released in 1995.



The first step in the investigation was to try to determine where exactly *Salmonella* could be found in the postharvest environment. Note, simply finding *Salmonella* and cleaning it up is *not* the root cause. How did it get there? Why did it persist? These are the additional questions that need to be answered. The team took nearly 200 swab samples in the facility in zones 1-4 *after* a full day's production. The team also asked detailed questions, and made their own observations, regarding sanitation and the control of hydrocooler water.

In the postharvest environment, *Salmonella* was found in several locations including at the hydrocooler and on the bottom of harvest bins stacked one upon another in the forced air cooler, which were visibly dirty and had already been through the hydrocooler. The sufficiency of hydrocooler antimicrobial management and clean-out, to include or exclude this as a contributor to persistent product contamination, was assessed. The team asked follow-up questions about why there was so much debris on the bottom of the harvest bins, and what practices were around their use, storage and cleaning. But where did the *Salmonella* come from? This led the team to investigate the preharvest environment.

The team visited three groves and interviewed staff to understand the production practices. Two of the groves were associated with recalled avocados; one was not but was used to store soil amendments. They again hunted for *Salmonella*, sampling soil, water (well water, sprinkler head, standing water etc.), bird feces, snails, biosolids, stored field bins, and other surfaces. The decisions on what to test was based on their own observations as well as employee interviews. The team kept an open mind regarding potential sources and vectors for *Salmonella*.

All three fields had some samples that were positive for *Salmonella.* This was not an unexpected finding, since *Salmonella* can persist in the environment. In the first field, positives were found in samples of standing water along a dirt road, as well as in a drag sample by a horse pasture and a soil sample in a different part of the field. In another field, positives were found in a fill well and a drag swab. Both of these fields had been associated with recalls. In the third field, two of three biosolid samples were positive, as was a drag swab south of the biosolid storage area.

The team learned that trees are side dressed with Class A biosolids through the year, and the process can generate dust. Multiple varieties of avocados are planted, that mature at different times, so sometimes the side dressing was applied close to the time a variety was going to be harvested.
For the purpose of this investigation, the research team did not need to further investigate the process to treat Class A biosolids to understand why *Salmonella* was present in the material. For class A biosolids for unrestricted use, *Salmonella* populations must be less than three most probable number (MPN) per four grams of total solids (dry weight basis) at the time the biosolids are used or disposed. Follow up quantification of *Salmonella* populations in the biosolids indicated that they are close to, or right at the 3 MPN/4 g specified (3 MPN/ 4 g is also the *Salmonella* limit for treated compost that is specified in the Produce Safety Rule).

Resolution:

The process identified class A biosolids as the likely source of *Salmonella* and identified possible routes of contamination (dust generated close to harvest, dust and debris on bins entering the facility from the field, and no documented cleaning and sanitation program for bins). As a result of the comprehensive evaluation, the firm was able to make several changes based on understanding the source, as well as possible routes of contamination.