## Episode Twenty Three - Infiltration

Welcome to episode 23 of Food Safety Bites, brought to you by the University of Wisconsin Madison, and funded by the USDA Food Safety Outreach Program, this is your host Harriet Behar. This episode is **understanding how bacteria can infiltrate into produce.** In these podcast episodes, I will identify issues, and provide suggestions for how to reduce various fresh produce contamination risks and keep your customers safe. We will not talk in detail about what is required for a GAP audit or a FSMA inspection. If you want more information on those, please see the links on the website where you found these podcasts.

Much of what I have discussed in these food safety bites episodes has focused on keeping bacteria, viruses and other pathogens from contaminating the outside skin of the produce. In this episode, I will focus on how these unwanted pathogens can infiltrate, colonize and grow on the inside of your produce, and how you can lessen that occurrence.

**Wounds, scrapes, cracks, splits, punctures, stem and blossom end scars**- Not all produce have a perfect outer skin or shell, as well all know. Some of these imperfections could have occurred during the fruits or vegetables natural maturing process, causing splits or cracks where bacteria could easily move into the interior of the produce. Many types of produce have fairly thin skins, which can be compromised through a variety of actions. Long fingernails can easily scrape or puncture a zucchini or a tomato. The stem ends of some vegetables such as summer squashes can be quite hard and if left long or cut on an angle, can easily puncture other squashes as they are placed in the harvest tote or waxed box. Peppers can be easily bruised when handled numerous times from the field to the cool storage, to the wash line and finally into the finished box. Harvest tools, totes and wash equipment all offer risk of scraping, bruising or otherwise compromising the exterior of the produce through some sort of wound. Many types of produce are attached to the main plant by the fruit's stem and when removed, there could be a slight tear that is open to contamination. These stem scars do not always provide this bacterial pathway, but many times when there is an opening, it may be so small we cannot see it. Even the cut stems of leafy greens could provide some risk. The quality and condition of the produce can be an important aspect that affects infiltration of bacteria into produce when placed in a tub of water.

**What is infiltration?** Infiltration is when water and potentially bacteria pass into fresh produce during immersion in water, such as in a dump tank during the washing step.

**What produce is most at risk?** Tomatoes, melons, apples and some more warmer climate items as avocados, oranges and mangos are the most at risk for infiltration, though it can happen in many products when they are being washed. They share some specific characteristics such as having a stem scar or a blossom end where bacteria can enter.

How does it happen? When produce is taken directly from a hot field and dunked into cold water, the differential in the two temperatures causes the air spaces within the produce to compress, resulting in a vacuum effect that can cause water to be sucked into the produce

through injuries, stem end, cracks and other blemishes. This infiltration can cause internal food contamination if there is bacteria in that water or on the skin of the produce. Subsequent washing steps, even in water treated with sanitizers, will not be able to effectively eliminate the pathogens that have infiltrated the fruit since they are within the cells of the produce.

**Lessening risk of infiltration**- There are a number of different factors that affect the rate of infiltration into produce and possible contamination. You can still wash your produce in a dump tank using cold water, but some basic steps and things to think about while yo are doing it will reduce the potential for infiltration.

**Sanitizer**- Water present in a dunk tank, sinks, flumes or recirculating systems should have a sanitizer to reduce or eliminate the possible survival of pathogens in the water. Then, if water does pass into the flesh of the produce, it will be less likely to have dangerous bacteria in it.

**Temperature differential** between the water and the produce is also important. When there is a larger difference between the cold water and the warmer produce, there is more risk of infiltration of that water through any cracks in the produce. Pre-cooling the field heat out of the produce by spraying with cold water or forced air cooling in a cold room can lessen that differential between the produce and the water once it is put in the cold dunk tank.

**The depth of the dunk tank** - The increased pressure caused by dunking produce into a deep tank of water, can also increase the amount of water that infiltrates the skin of the produce, so using shallow dunk tanks can mitigate this issue

**Time in the tank**- The longer time the produce spends in the dunk tank, the more likely there will be water infiltration into the produce. Look at perhaps spraying the produce with cold water rather than dunking it if it is a crop that can tolerate a spray on a spray table or have a system that allows the workers to remove the produce quickly from the dunk tank so processing line doesn't get backed up which results in the produce sitting longer in the water than it should. Try to not have that produce in the water longer than 5 minutes.

**Review the produce** before it is dunked, and make sure there are no obvious wounds or other skin compromises. The maturity of the produce could affect how likely water would be taken into the interior of the produce, with immature produce taking up water more quickly than produce that is fully ripe.

**Water-** Dunk tank water should have the correct level of sanitizers and used for as clean a produce as possible to avoid loading up that water with bacteria. You now know how easy it is for that produce to suck up that water. Monitor the quality of that water. I will discuss the important topic of post-harvest handling water in another episode. The water used in all post-harvest handling activities should be the microbial equivalent of drinking water - that is, it does not have any detectable Generic E. coli in it per 100 ml sample. Dunk water that is 10 degrees warmer than the interior temperature of the produce could prevent or dramatically reduce the potential for infiltration. Investing in a probe thermometer to sample produce temperature is a useful tool (less than $20) and should be sanitized between uses.

**Forced air cooling**- This type of quick and effective cooling can be done both at a large and very small scale and can rapidly chill down produce to an acceptable temperature before it is placed in a cold-water wash tank. Totes of produce with slatted sides can be stacked in parallel rows with an aisle between. A tarp can be placed over that aisle with a good-sized fan blowing air out on one end. The cool air is then pulled through that little wind tunnel. It has been shown that this active air cooling can chill produce down 75-80% faster than putting produce directly out of the field into a cooler.

So that's it for this episode of Food Safety Bites, the next episode is managing ice. This is your host Harriet Behar brought to you by the University of Wisconsin Madison, talk to you next time!