Standard Operating Procedures and Best Practices for Bin Management in Pacific Northwest Tree Fruit Orchards to Mitigate Potential Food Safety Hazards

Northwest Horticultural Council

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Following the harvest of Pacific Northwest apples, pears, and cherries, fruit is placed into bins in the orchard. These bins are made of wood or plastic and reused year after year. Each grower and/or packer has their own protocol for determining when bins are removed from circulation. These protocols, while customized at the operation level, are designed to comply with regulatory standards like the Food Safety Modernization Act (FSMA) Sanitary Transportation Rule, which prohibits the use of bins with jagged edges that could damage the fruit.

Once loaded with fruit, bins are transported by forklift and/or tractor and bin trailer to a loading area, where they are loaded onto a truck. Fruit-loaded bins are then transported to either a cold storage facility or a packinghouse. Bins are stacked on top of each other throughout transport and storage. The bottoms of bins do not touch the fruit in the bin below, although it is possible for dirt or debris to fall between bins.

- It is a best practice to minimize the amount of organic material (e.g., leaves, soil) that enters the packinghouse with fruit (i.e., in or on the bin), as it can affect fruit quality, and as indicated by environmental monitoring, can increase the potential for indicator organisms associated with foodborne pathogens to be present within the packinghouse.
- When possible, it is a best practice to stage bins on pavement or gravel to minimize the amount of soil that may be transferred to the bins during handling (e.g., picked up by a forklift).
- In many cases, bins must be staged on grassy areas in order to be accessible by pickers. When possible, it is a best practice to stage and pick up bins when the ground is dry, minimizing the creation of mud that could increase the amount of organic material and moisture that may be transferred to the bins.
- It is a best practice to train forklift drivers to transport bins in the orchard in a manner that minimizes the amount of soil picked up with the bin. This includes training drivers to lift the bin off the ground as quickly as possible to minimize the movement of the bin while in contact with the ground, and to visually assess bins to ensure the absence of excessive soil or plant material prior to unloading onto another bin of fruit.

Fruit remains in the bin it was originally picked into until the time of packing. This length of time varies, depending on commodity, variety, fruit quality, and type of storage. For example, cherries will likely be packed within one-to-three days of harvest. Alternatively, some apple

varieties that are stored in controlled atmosphere storage may not be packed until 12 months after harvest.

At this point, the process varies slightly for apples, pears, and cherries:

Apples: Prior to going into storage, bins full of apples are routinely drenched with a fungicide to reduce and/or prevent decay. Upon arrival at the packinghouse, bins are submerged in water treated with an antimicrobial agent (i.e., chemical sanitizer), such as peroxyacetic acid (PAA) or chlorine (e.g., calcium hypochlorite, sodium hypochlorite), for approximately 30-60 seconds (sometimes longer) to allow apples to float into the flume system. Water quality is monitored using appropriate parameters depending on the sanitizer used (i.e., parts per million sanitizer, oxidation reduction potential). While the schedule for changing out the water varies from packinghouse to packinghouse, it is based on criteria outlined in each packinghouse's food safety plan and often governed in part by other regulatory considerations, such as wastewater discharge permit requirements. In addition to facilitating entry into the dump tank with minimal damage, this process also removes organic material from bins and exposes them to a sanitizer.

Pears: Bins are submerged in water treated with a sanitizer (e.g., calcium hypochlorite) for approximately 30 seconds. Water quality is monitored using appropriate parameters depending on the sanitizer used (i.e., parts per million sanitizer, oxidation reduction potential). As with apples, water change schedules vary but are based on the packinghouse's food safety plan and related regulatory requirements. Also like apples, this submersion removes organic material from bins and exposes them to a sanitizer.

Cherries: In most cases, bins are passed through a hydrocooler with water containing an antimicrobial agent for three-to-four minutes to remove field heat from the cherries. This step also helps remove any organic material from the bins. Treated water is managed in compliance with the FSMA Produce Safety Rule postharvest water requirements for recirculated water. Bins are then submerged in water treated with a sanitizer on the packing line for 30-60 seconds. Water quality is monitored both in the hydrocooler and on the packing line using appropriate parameters dependent on the sanitizer in use. While the schedules for changing out water vary, they are based on packinghouse food safety plans and may also reflect wastewater regulatory requirements. In addition to allowing the cherries to enter the flume with minimal damage, this process also removes organic material that may be present out of the bins and exposes them to a sanitizer.

Following submersion of the bins in treated water to remove the fruit, the process is once again consistent across all three commodities. Some tree fruit packers run some or all of their bins through a mechanical bin washer. However, these machines are not essential, and not all packers have them (or enough capacity to use mechanical bin washers on every bin). If no mechanical bin washing is used, visual inspection and manual cleaning protocols (when necessary) are crucial to food safety programs/plans. Once empty bins leave the packinghouse, they are either moved to another orchard to be filled again during the same harvest season, or to on- or off-farm

storage until they are needed the following season. Bins are stored outside, in compliance with the FSMA Sanitary Transportation Rule.

- It is a best practice for bins to be visually assessed for cleanliness and physical damage following extraction from the dump tank (before delivery to storage or back to the orchard).
    - Should organic material be observed on the bin, it is a best practice to pull the bin aside for additional cleaning (either by hand or use of a bin washer) before it goes back into the orchard or to storage.
- When possible, it is a best practice to store bins on pavement or in gravel lots to minimize soil contact.
- In some cases, bins must be stored in grassy areas. In these instances, it is a best practice to have a pest management program in place to control rodents or other animals that may serve as a source of contamination to the bins.

In the days or weeks leading up to harvest, bins are loaded onto trucks and taken out to be staged in the orchard in preparation to be loaded with fruit. How bins are staged varies from farm-to-farm. While some growers prefer to stage their bins facing up, there are certain circumstances, including limited space due to certain orchard structures, in which bins must be staged on their side.

- It is a best practice to have a pest management program in place in the orchard, which reduces the risk of contamination of harvest bins by pests.
- When possible, it is a best practice to ensure that the inside of a bin is dry prior to filling it with fruit. (An example of when this may not be possible is if it rains immediately prior or during harvest, which is a rare occurrence in the Pacific Northwest tree fruit growing region.)
- It is a best practice to visually assess bins when the growers receive the bin and/or when they are first staged in the orchard and pull aside for additional cleaning (and sanitation, if necessary) any bins where organic material that could serve as a harborage point for pathogen growth, or evidence of animal intrusion, is observed.
- Where possible, it is a best practice to stage bins where agricultural water does not come into contact with the bin. In orchards where avoiding all contact with agricultural water is not feasible, it is a best practice to minimize agricultural water coming into contact with the inside of the bin (which comes into direct contact with fruit).
    - It is important to note that typical harvest weather conditions in the Pacific Northwest support the die-off of *E. coli*, that irrigation water in the region has demonstrated low microbial loads, and that the final irrigation generally occurs more than 12 hours before fruit is placed into bins.
- While it is expected in an open environment that a few leaves or a small amount of dirt may enter a bin immediately before or during harvest, it is a best practice for pickers to

conduct a final visual assessment of the bin (regardless of whether it was staged facing up or on its side) before filling it with fruit to ensure that there is no significant organic material (e.g., soil or leaves) that could serve as a harborage site for pathogen growth, or evidence of animal intrusion. It is also a best practice to minimize the number of leaves that enter the bin with the fruit during picking.

Summary:

The presence of organic material in bins is a recognized indicator of the potential for foodborne pathogen cross-contamination. With tree fruit grown in the open environment, it is inevitable that bins are exposed to potential hazards from organic material and animal intrusion.

Ensuring that bins are of adequate cleanliness and sanitary quality for their intended use is a shared responsibility between growers and packers, with risk reduction achieved through a multi-stage process that is, in some part, dependent on what is possible in the individual circumstances of the orchard at the time of harvest. This is done through best practices ranging from employee training to bin staging, a cleaning of all bins as they go into the dump tank, pest management programs, and multiple visual inspections, with bins pulled aside for additional cleaning when needed (including immediately before fruit is placed in the bin).

This document was reviewed by the following produce safety extension specialists: Dr. Claire Murphy of Washington State University, Dr. Laura Strawn of Virgina Tech, and Phillip Tocco of Michigan State University.