



Produce Food Safety: Packing & Storing

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Introduction

If you intend to sell your produce, you'll need to package it. Some growers immediately assume that they'll need a large, complicated packing shed with state-of-the-art technology. Typically this is not the case, and for some situations you might not need a packing facility at all. Before we go into some of the best practices for managing a packing shed, you should first consider whether you need one at all. Many of the practices discussed in this publication will depend on the requirements of your buyer. The first step before making upgrades to your food safety infrastructure is to talk to your buyer—ask them how they expect products packaged, box sizes, and whether they expect the product to be washed. Do they currently expect a third-party Good Agriculture Practice (GAP) audit? Do they anticipate requiring one in the near future? As long as you are meeting all regulatory requirements and taking common sense steps to keep your produce safe, there is no need to exceed the expectations of your buyer. In the case of Farmers Markets and CSAs, the expectations for washing can be highly variable. Talk to other vendors in your area and your customers, to get a sense of what is expected. Simple conversations about expectations can save you thousands of dollars in prep time, supplies, and audit costs. Based on a conversation with your buyer, you will likely settle on one of the two packing approaches described below.

Field Packing

Field packing is a good option for buyers that do not require a washed product. As its name implies, field packing produce is placing harvested product directly into a sanitary final container, while in the field. Some growers may prefer a “bin-

in-bin” system where sanitized, closed-bottom plastic bins are placed on the ground in the field and then single use boxes are placed inside the plastic bins. As the single use boxes are filled with harvested produce, they are passed off to a clean trailer for transport to the cooler. The box is replaced with a new one and the process repeats. This way the single use boxes never touch the ground and can be stacked since there is no soil on the bottom of the box. The single use boxes must be kept clean during harvest and covered on the way to the packing house or cooler. You could alternatively do a bin-in-bin system using reusable plastic harvest bins, but it would be important to keep the ground contact and sanitized harvest bins separate.



A harvesting conveyor can help to speed field packing.

A harvesting conveyor can keep produce-to-soil contact at a minimum while field packing. Workers place harvested produce on a conveyor belt that feeds the produce to the trailer or wagon, where other workers pack the produce into its final box. As with field packing, the boxes must be kept clean on the trailer and covered on the way to the packing



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house or cooler. If field packed product is acceptable to your buyer(s), this can completely eliminate the need for a packing house facility. In the case of GAP third-party audits, not using a packing shed greatly reduces the complexity of the plan and audit.

Elements of a Food Safe Packing House

Many producers are worried that they will need a completely enclosed packing space to meet GAP standards. An enclosed house packing facility is best, but an open house packing facility—one without walls, doors, etc.—can meet GAP audit standards if a comprehensive pest monitoring and prevention program is used. There are a number of other variables you'll want to consider.



Plastic reusable bins and plastic pallets. Both should be cleaned and sanitized before each use.

Protecting Produce

Packing house food safety is an extension of food safety precautions you take in the field. The overarching principle here is that any surface that produce will touch must be washable and sanitizable. This includes tabletops, washing equipment, dunk tanks, spin driers, boxes, crates and any other surface involved in packing. Plastic and stainless steel are two of the best and most commonly used materials. Wood is discouraged, but wood painted with food grade paint does meet the washable and sanitizable criteria above. You should only use either new one-use containers (wax boxes, etc.) or sanitizable reusable containers to pack your product. **DO NOT** re-use wax or cardboard boxes—they are not sanitizable and pose considerable food safety liability. Before, during, and after packing, your one-use containers or sanitized bins should be kept off the floor, away from walls in a covered area, and free from possible contamination of pests. If boxes are to be stacked, pay close attention to the surfaces

you place the boxes on. You should always keep your product off the floor. Clean, sanitizable (plastic) pallets in good condition work well for this purpose.

Design & Maintenance

Sufficient lighting is required for a packing house, and you should install coverings for any overhead lighting to prevent bulb breakage. Any piping, duct work, fans, etc. overhead need to be maintained and able to be cleaned as needed. Pathways should be clear of clutter and debris. Floors should be washable and the packing house should be free of standing water. A typical configuration meeting these criteria would include concrete floors that pitch toward one or more floor drains. You or your workers will need to ensure that these drains remain free of obstructions. Interior walls and floors can sometimes contain cracks and crevices that allow water entry. The facility should be regularly inspected and cracks and holes should be filled with the appropriate sealant.



Light coverings prevent shattered bulbs from getting into your product.

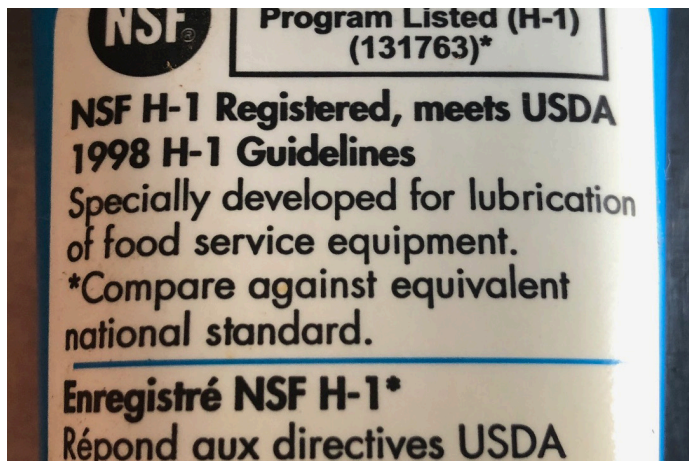
The ideal floor surface is one that can be easily and frequently cleaned (swept and/or sprayed down). A poured concrete slab is the best example of this kind of flooring material. The truth is this kind of flooring is not a reality for many farms. The FSMA Produce Rule does not explicitly state that a packing house cannot have gravel or dirt floors, just that the facility can be maintained in such a way that it does not pose a risk of contamination to produce. If you have a packing house with a gravel or dirt floor, the first priorities should be keeping produce off of the floor and minimizing standing water. If you are building a new structure, consider installing a concrete floor. Some Third-Party GAP audits may have specific flooring requirements, so be aware of this before you pursue an audit.

Don't forget about the area around your packing house. Make sure that the area around the house is mowed, free of standing water, and free of litter and debris. Standing water around the packing shed poses major risks of cross-contamination and water splatter. Keep garbage receptacles or dumpsters closed and store them away from the packing facility entrance. You should remove waste generated during the packing process on a regular basis.

Equipment and Supplies

Standard Operating Procedures (SOPs) for the packing house include details of how surfaces and equipment should be cleaned. These SOPs should include a regular cleaning schedule as well as the materials and chemicals used to clean and sanitize. Maintain regular cleaning records. It's often helpful to designate a specific person to check these records to make sure the regular cleaning schedule is happening. Cleaning equipment such as sponges and brushes are consumable and must be replaced on a regular basis. Document the replacement. Any water that is used in the cleaning of the packing house must be potable. Direct wastewater drainage or spillage away from the food handling area using barriers, drains, or simply locating outlets at a sufficient distance.

Use only food grade approved and labelled lubricants on packing equipment or machinery. Only purchase and use surface sanitizers (like bleach) that are labeled "food grade." Chemicals that are not food safe or that are not approved for use on the product must be stored and segregated from the packing area. Equipment and tool storage areas should be segregated from the packing area.



Ensure that cleaners, sanitizers, and lubricants are specifically labeled "food-grade"

Pest Control

You will need a set of pest control SOPs for the house packing facility. The main goal of a pest control program should be prevention and exclusion of pests. Regular, recorded inspections for pest infestation (most likely rodents, insects, or birds) is an important step. Designating one of your employees to complete this kind of check is a good idea. If pests are found in the packing house, take appropriate action to eliminate them. These appropriate actions should also be included in the Food Safety Manual. All SOPs and interventions should be included as a SOP in the Food Safety Manual, and you need to keep records that the program is being followed.

If a pest control service is used, the service report should be kept and made available if necessary. Generally, it is a good idea to place glue-based rodent traps strategically around the perimeter of the packing house and in coolers. You should have an SOP to check these traps regularly. Major cracks and crevices in the packing house should be repaired as necessary. Mice need only a quarter-inch hole to enter a building. The exclusion of birds can be more challenging in an open packing house and you will need to inspect rafters every day if the packing house is unenclosed. You can also use bird netting or bird spikes to prevent nesting.

Washing Produce

Washing is not a required step for GAP certification, but is sometimes required by buyers, especially for leafy greens. As a rule—if you can avoid washing your product, then don't wash it. You will need to check with your buyer or market regarding expectations or common practices regarding washed produce. Washing the product adds a secondary set of complication and risk for food safety, but if you must wash your product, follow the guidance below.

Any water source that will be used to wash produce must meet the U.S. Environmental Protection Agency (EPA) microbial standards for drinking water. If you will be using a spray wash system that recirculates water or an immersion wash system, you should add an A approved food-safe sanitizer to the wash water. You should regularly check the sanitizer concentration in the wash water using test strips (Ex: pH and free chlorine). Follow the label instructions for adding sanitizer to wash water. As with pesticides, the label

is the law.

After washing, you want to remove surface moisture from your product. Allow produce such as tomatoes, melons, cucumbers, berries, and tree fruit to air-dry. Spin-dry leafy greens to remove surface moisture. You should wash, rinse and sanitize any containers, sinks, or sprayers to avoid the development of a biofilm. A biofilm is a group of microorganisms that stick to each other, and typically to a surface. They form a protective layer that prevents surface sanitizers from effectively killing them. Use a scrub brush to clean, then rinse and sanitize the surface. Allow sanitized surfaces to air dry. You should have an SOP to wash, rinse and sanitize all parts of the spinner contacting the produce. For third-party GAP, converted clothes washers are not allowable as they cannot be completely disassembled, cleaned and sanitized.

Worker Health and Hygiene

Many of the good health and hygiene practices you follow in the field apply in the packing house as well. Any employee facilities such as bathrooms, locker rooms, break areas, etc. should be located away from the house packing facility. There should be no eating, drinking, or smoking in or around the packing area. Store food, water, and personal effects away from the produce packing areas as well.

As in the field, employees should always wash their hands immediately before handling produce.

This includes after breaks, after using the bathroom, after smoking, and after touching anything that could contaminate the produce. Employees should receive proper training on handwashing and using the

designated bathroom facilities on their first day of work. Post signs to remind employees about the importance of proper hand washing.



Employees should be in good health and wearing clean clothing and footwear. This can become a concern if the same employees will be participating in harvest and entering the packing house on the same day. Designate a place away from the packing house where employees can change their field boots for clean boots. Employees may also want to have a change of clothes if they get too dirty during harvest. Broken glass or a dropped earring poses a major risk to consumers, so leave glass and jewelry in the separate area with food and personal items. Ask employees to tie back their hair and/or wear hats to protect hair from contaminating the product.

Storage and Transport

If you will be storing produce before transport to its final location, your storage facility should be clean and orderly, regularly inspected for foreign material that could contaminate the product, and closed and protected from external contamination. Just like a Food-Safe packing house, your storage area or facility should be free of any standing water, litter, or debris. Wastewater contamination of product in storage areas can come from dripping condensers in coolers, leaky roofs, or many other sources. You should protect your product from these potential sources of contamination by using distance, barriers, or drains.

You should have a SOP that describes how you would handle and dispose of any finished product that becomes contaminated or comes into contact with the floor. Don't forget to protect packing materials from potential contamination. Most single-use packing materials consist of cardboard, which can be attractive to pests like rodents and birds. You should keep these packing materials off the ground, away from the walls, and sealed until ready to use. Pallets and bins should be in good condition and should not contribute any foreign material to the finished product. If product is stored outside in a staging area before being moved into the storage area or onto a transport vehicle, it must be covered and protected from contamination.

Pesticides, fertilizers, fuel, paint or other chemicals that are not food grade should not be stored in close proximity to the finished product. If you use any mechanical equipment in the storage area you should perform regular maintenance and keep it clean so as to not contaminate the product.

Pest Control

Just like the packing house, your storage facility will need a set of pest control SOPs. Again, the main goal of a pest control program should be prevention and exclusion of pests. This includes maintaining and inspecting the facility regularly to make sure that there are no cracks or crevices in the walls, floor or ceilings, in which pests could enter or nest. Non-baited traps for rodents help to monitor any intrusion. If a pest control service is used, the service report should be kept and made available if necessary.



Rodent traps like this are part of preventative pest management.

Ice and Refrigeration

All water used for cooling and/or making ice must be potable. Sanitize all icemakers and containers or tools used to carry or store ice. This includes the ice machine, scoops, bins, or anything else that comes in contact with the ice. If you are using a cooler or any other type of temperature controlled room, you should monitor the temperature and keep a log. The thermometers used to keep the temperature should be calibrated on a yearly basis. Water dripping from ice packed product and condensers is considered wastewater and should be kept from contaminating finished product. If a product is iced, it should be kept from dripping on any product below.

Transportation

Transport vehicles and any equipment that is used to load product onto transportation vehicles must be clean, in good condition, and free of dirt and debris. When product is transferred to vehicles it must be treated carefully so that it is not damaged. You must have an SOP that specifies a maintained temperature during transport. While this does not mean you have to use a refrigerated vehicle, you should seek to minimize vast swings in temperature that could

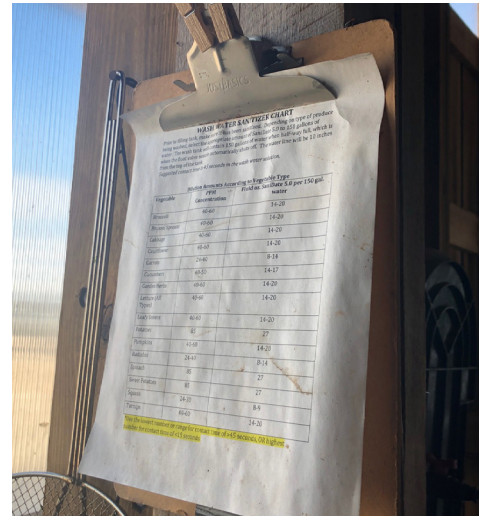
damage the product and make it susceptible to contamination.

Worker Health and Hygiene

As with the packing house, break areas and other employee facilities should be located away from the storage area. Visitors and employees must follow any written policy on hair/beard nets or jewelry in the storage area.

Record Checklist

Based on USDA GAP Audit Checklist



Record keeping and documentation does not have to be complicated. A simple, inexpensive method like a clipboard and pen works well if used.

Documents

- Temperature monitoring in dump tanks
- Process water treated to reduce contamination
- Zone 1 (water & food contact surfaces) cleaned/sanitized regularly
- Water treatment is monitored and appropriate
- Zone 1 in good condition, cleaning logs maintained
- Only new or sanitized containers are used for packing
- Measures are taken to exclude animals or pests from packing & storage
- Established pest control program for facility
- Records kept for incoming product and destination of outgoing product

Policies

- SOP for hair/beard nets – enforced if there is a policy
- SOP for jewelry – enforced if there is a policy
- SOP for handling finished product that is dropped

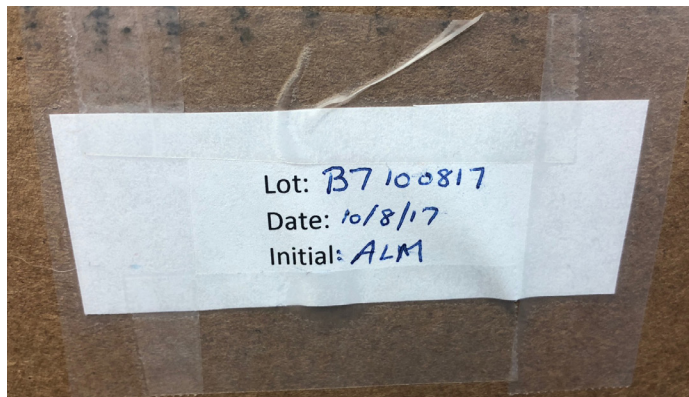
on floor

Records

- Water testing – potable quality (includes ice making water)
- Ice is produced, transported, and stored in sanitary conditions
- Food grade lubricants only
- Pest control program records

Note on Traceability

Traceability is being able to account for your products one step forward and one step back. For a grower, one step back means being able to identify in which field a particular commodity was grown, and one step forward would mean, who bought from the farm. Traceability allows for targeted recalls of potentially contaminated products. It also helps in monitoring the quality of your product such as a buyer identifying a quality issue with a particular box of product. It's also a valuable tool for tracking the variety and volume of products the farm is selling. Traceability is easiest when growers have clear methods for assigning lot numbers to their fresh fruits and vegetables. For large farms, one lot could be all tomatoes harvested from field 1 or all tomatoes packed before noon on a given day. For small scale growers, a lot could be a day's worth of harvest. Lot numbers/codes enable growers to have an effective tracking system. Remember that—in the event of a food safety issue—the bigger the lot, the bigger the recall.



Larger operations will likely use barcodes, and other technology to track orders, but a simple lot code label like this may work for smaller farms

Defining a lot includes coming up with a lot code that identifies your fields, commodities and varieties, harvest date, harvest crew, packing shed, packaging date, packaging crew. The code itself need not

contain all this information but should eventually be able to get you to this information when needed. A lot code could be a simple month, day, year format (MM-DD-YEAR) or it could be a Julian date (1 for first day of the year and 365 for the last day of the year). These lot codes could either be written on field loading tickets if produce is being transferred to a packaging facility or it could be attached to sellable containers. Labeling with lot codes will enable you to identify every container going out of the farm gate.

Conclusion

Your operation's scale and the expectations of your buyers will determine the way you pack your product. The simpler you keep your operation, and the fewer elements you incorporate into your packing plan, the easier it is to minimize food safety risks. If your market does require a more sophisticated packing scheme, just remember to document all of the things you are doing to mitigate potential risks. Train your employees and ensure that they are following the food safety protocols that you have put in place. Before jumping into a new market, make sure to ask about any food safety certifications or practices they require. If you have questions along the way, contact us.

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References:

Cornell University College of Agriculture and Life Sciences. 2015. Produce Safety Alliance (PSA), FSMA Produce Safety Rule. Train-the-Trainer Manual.

United States Department of Agriculture—Agricultural Marketing Services (USDA-AMS). Good Agricultural

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