

Production & Postharvest Food Safety

Mark Ritenour

Assistant Professor and State Extension Specialist

Postharvest

Why is Sanitation Important?

Sanitation is an important part of production and postharvest food safety. Unsanitary conditions provide inoculums for decay causing organisms, which causes increased product loss to decay. Unsanitary conditions also promote contamination with human pathogens. An example of this is *Cyospora*, which is present on raspberries and lettuce. Effective sanitary practices are part of an integrated program from "field to fork."

It is essential to prevent contamination because once a product is contaminated; it is difficult to remove the pathogens. The major source of contamination comes from animal feces. Other possible sources of field contamination include: soil, fertilizers, equipment, foreign materials or debris, cleaning/sanitizing materials, insects or rodents, animals that have access to the field and animal feces, contaminated water and poor worker hygiene.

Animal feces are a main source for pathogenic organisms. Since animals are in contact with soil, manure and water, they can easily pick up contaminants from these sources and transport them to fresh fruit and vegetables. There are many steps that can be taken to reduce the potential for contamination from animals. Animal access to fresh produce fields should be minimized. Maintain domestic and farm animals away from production fields and packing facilities and establish physical barriers or vegetation to avoid animal entry. These precautions are especially important in the field near harvest time. Try to keep domestic animals (e.g. dogs) out of field, equipment/storage areas, and harvested product staging areas. Dead or trapped animals such as rats, birds, insects, etc., should be disposed of promptly. Maintain good records of your animal control programs. Pest control is also essential. Maintain an effective pest control program. Do not allow animals into packinghouse (domestic or otherwise). Prepare cartons only as needed.

Fertilizer and Water Use

Quality fertilization practices are also a must. Inorganic fertilizers originate from synthetic chemicals; so pathogenic bacteria are not likely to be present. Incompletely treated manure and biosolids may contain pathogenic bacteria. Therefore you should

only use well-composted manure and isolate treatment areas away from fresh produce fields. Maintain records of safe fertilization practices.

Water destined for agricultural production can easily become contaminated with human and/or animal feces by direct or indirect routes. Sources of water contamination include bacteria and viruses, domestic waste, nitrate nitrogen, synthetic organic chemicals, heavy metals, petroleum residues and combustion products from roadways. Anytime water comes in contact with fresh produce, it's quality determines that potential for pathogen contamination since water may be a carrier of a number of types of microorganisms. A list of possible microorganisms includes: *Escherichia coli*, *Salmonella* spp., *Vibrio cholerae*, *Shigella* spp., *Cryptosporidium parvum*, *Giardia lamblia*, *Cyclospora cayetanensis*, *Taxisplasma gondii*, the Norwalk virus and hepatitis A. Water used for agricultural purposes usually comes from surface sources such as rivers, streams, irrigation ditches and canals, reservoirs (open or capped), or municipal water systems.

Surface water may contain pathogens and parasites of humans. Well (ground) water is less likely to harbor pathogens, depending on depth, but may contain pesticide chemicals. Overhead irrigation is more likely to spread contamination to above-ground plant parts than root-zone irrigation (furrow or drip). The proximity of water source to livestock should be considered due to the possibility of runoff. Due to this, you should maintain separation in distance and topography. You should also maintain records of safe irrigation practices. Know the quality of irrigation water and rinse water in the field. The quality of water contacting edible portions of a plant must be high and the water should be tested for bacteria, protozoa and viruses. Water applied to crops for other purposes (frost protection and pesticide application) must also come from a safe source.

Microbiological testing is used in the verification steps of a safety assurance program, not as a daily procedure. It is important to document the frequency and results of each water test for comparison purposes. These records would become very important in the event of a microbiological outbreak investigation. The water source will determine the possible frequency of testing, as shown in the following table.

Source	Possible Water Testing Frequency*
Closed system, under the ground or covered tank	One annual test at the beginning of the season
Uncovered well, open canal, water reservoir, collection pond	Every three months during the season
Municipal/District water system	Keep records from the municipality/district water system (monthly, quarterly or annual report)

*Obtained from California, Strawberry Commission (19989) Quality Assurance Program

The Importance of Good Water Hygiene

Proper hygiene procedures should be established and included in hygiene and health training programs of all employees. They should be taught how to correctly wash their hands and how frequently. Eating areas should be kept separate from fresh produce. Sick employees should be encouraged to stay at home. An infected employee (showing symptoms or not) can easily contaminate fresh produce and spread illness to other employees. If an employee has a wound, it should be covered so that they do not contact the product. All employees should be trained to follow good hygiene practices. Toilets and sinks should be well-supplied and should maintain sanitary.

Site Selection

Before selecting a site you must take several things into account. What is the land use history? If there were once grazing animals on the land or exposure to hazardous chemicals, there could be possible water contamination. The current proximity to livestock operations should be taken into consideration. Cull piles, refuse dumps and debris should be kept away from production fields. There should be proper facilities for worker sanitation. Before planting on the site, there are several important things to know:

- If the field has been used for animal feeding
- If the field has been used for domestic animal production
- If the field has been used as a garbage or toxic waste disposal site
- If the field has been used for mining activities, oil or gas excretion
- If the field has been used for the disposal of incineration materials, industrial waste or if mineral residues exist on the site
- If the field adjacent to the production site has or had farm animals at a short distance to the cultivation site
- If the field has experienced any serious flooding
- If the field has been treated in an uncontrolled manner with organic and inorganic fertilizers and/or pesticides

Sanitation During Harvest Operation

During harvesting, avoid contact between fruits, vegetables, bins, etc. and the soil. Avoid bruises or cuts to the fruits or vegetables that may allow internal contamination. Protect harvested product from animals and animal feces. Do not use open water sources for field washing. Provide restrooms and hand-washing stations. Clean and sanitize bins and harvest equipment before each use.

Packinghouse Sanitation

In the packinghouse, produce from many fields come together. Any errors preharvest can contaminate clean uninfected fruit at the packinghouse. Errors at the packinghouse are amplified. There are many sanitation hazards inside the packinghouse. Packing and

storage facilities should always be maintained in a clean condition. Water sanitation, employee sanitation practices, equipment sanitation and animal exclusion are all methods of keeping a clean condition. Clean potable water should be used. Know the quality of water used in the packinghouse and test for bacteria, protozoa and viruses. Sanitize recirculated water systems. During packinghouse operations, keep dirty fruit from the field separated from the clean, packed fruit. Wash dirty fruit outside the packinghouse. Clean and sanitize packing areas, storage rooms, fruit bins and equipment. Prime sites for pathogen growth are areas that remain wet (Brush/sponge rolls, floors) and plant debris left on the line or packinghouse floor. Handle produce carefully to prevent wounds. Remove injured product from the facilities. Discard fruit that fall on the floor. Remove cull fruit and debris promptly.

Sanitation in the packinghouse is critical. Sanitize facilities and equipment regularly. Daily chores include change dump tank water; packing line equipment (particularly that remain wet); floors; drains; break rooms/bathrooms. Chores that should take place monthly or between loads include cold room - floors, walls, ceilings, refrigeration coils, doors, and curtains. Room and equipment cleaning procedures are as follows;

- Empty and sweep cold rooms
- Pre-rinse equipment or walls
- Visually inspect surfaces
- Apply appropriate cleanser (scrub from top, downward)
- Do not allow cleanser to dry on surfaces (rinse from top, downward)
- Visually re-inspect surfaces
- Apply a high level sanitizer (800 ppm quaternary ammonia)
- Let stand for 20 minutes
- Rinse with potable water
- Apply regular level sanitizer (200 ppm quaternary ammonia)
- Rinse with potable water
- Always rinse ammonia products before adding chlorine (e.g. dump tanks)

Temperature Control

Temperature control is important. Low temperatures supplement good sanitation practices. Avoid delays that postpone cooling. You must consider the time from harvest to the packinghouse, the time from arrival to cooling off procedure and the speed of cooling and final temperature. Storage and transport temperatures are also important. Most human pathogens grow slowly or not at all below 45 degrees F or 7 degrees C. *Listeria monocytogenes* is a special consideration in refrigerated environments. Besides slowing down pathogen growth, cooling also reduces water loss, reduces decay and decreased respiration which in turn increases shelf life.

For more information see the UF postharvest website: <http://postharvest.ifas.ufl.edu>

Information on the Internet

- Guide to Minimize Microbial Food safety Hazards for Fresh Fruits and Vegetables
<http://www.foodsafety.gov/~dim/prodguid.html>
- Gateway to Government Food Safety Information
<http://www.foodsafety.gov/>
- National Food Safety Programs
<http://vm.cfsan.fda.gov/~dma/fs-toc.html>
- Good Agricultural Practices Program
<http://www.gaps.cornell.edu/>
- Other Food Safety Links
<http://foodsafety.ucdavis.edu/fslinksframe.html>

The Institute of Food and Agricultural Sciences (IFAS) is an Equal Employment Opportunity - Affirmative Action Employer authorized to provide research, educational information and other services only to individuals and institutions that function without regard to race, creed, color, religion, age, disability, sex, sexual orientation, marital status, national origin, political opinions or affiliations. For information on obtaining other extension publications, contact your county Cooperative Extension Service office.

Florida Cooperative Extension Service / Institute of Food and Agricultural Sciences / University of Florida / Larry R. Arrington, Dean