



POSTHARVEST HANDLING AND COOLING OF FRESH FRUITS, VEGETABLES, AND FLOWERS FOR SMALL FARMS

Part I: Quality Maintenance

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Fresh fruits, vegetables and flowers must be in excellent condition and have excellent quality if maximum shelf life is desired.

The best possible quality of any commodity exists at the moment of harvest. From that point on, quality cannot be improved, only maintained. Remember that **shelf life begins at harvest.**

Commodities that will be stored should be harvested at optimum maturity, because storage life may be reduced if they are immature or overmature. The proper maturity for optimum storage life of products is discussed under individual commodity requirements in USDA Handbook No. 66. All commodities destined for storage should be as free as possible from skin breaks, bruises, spots, rots, decay and other deterioration.

Fresh fruits, vegetables, and flowers may be infected with various pathogens which are not visible prior to storage but will cause decay and rot during storage and transportation. The amount of developing infection should be determined prior to storage, by examining samples for cuts, severe bruises, and rotting tissue. Only lots free of infection should be considered for long-term storage because damaged and decaying products can infect those that are sound and may possibly result in losses of entire lots.

Deterioration of fresh commodities can result from physiological breakdown due to natural ripening processes, water loss, temperature injury, physical damage, or invasion by microorganisms. All of these factors can interact, and all are influenced by **temperature.**

Fresh fruits, vegetables, and flowers are **highly perishable because they are alive.** They breathe (just like humans), release heat from respiration, and, consequently, **lose moisture**, which may detract from their appearance, salable weight, and nutritional quality. They can become sick, deteriorate, and die. Dead fresh fruits and vegetables are not marketable!

Water/Relative Humidity

Fresh horticultural commodities are unique packages of water! In fact, **freshness is water, and freshness sells!** **Water loss** is one of the main causes of deterioration that reduces the marketability of fresh fruits and vegetables. Profitability in fresh fruit, vegetable, and flower sales depends on the ability to deliver as much of this water as possible to consumers.

Effects of water loss – Many fruits, vegetables, and flowers become shriveled after losing only a small percentage of their original weight due to water loss.

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Severe desiccation results in considerable losses; e.g., wilted leafy vegetables may require excessive trimming to make them marketable, and grapes may shatter loose from clusters if their stems are severely dried. Seriously shriveled fruits, vegetables, and flowers are unmarketable and must be discarded. **Water loss represents salable weight loss and reduced profits.**

Factors affecting water loss – Relative humidity, the temperature of the product and its surrounding atmosphere, and air velocity all affect the amount of water lost from fresh fruits, vegetables, and flowers. Water loss from warm products to warm air is particularly serious under windy conditions or during transport in an open vehicle.

Maintaining high relative humidity is sometimes difficult due to the fact that refrigeration removes moisture. Humidification devices can be used in storages; e.g., spinning disc aspirators, etc. Keeping the floor wet is also helpful, but is messy and may harbor disease organisms on old produce on the floor. Therefore, frequent sanitizing procedures should be employed; e.g., cleansing frequently and rinsing with a weak solution of chlorine bleach. Commodities that can tolerate direct contact with water can be sprinkled to promote high relative humidity. Enveloping commodities in plastic films will also help maintain high relative humidity.

Respiration/Heat

Respiration is the process by which stored organic materials (carbohydrates, proteins, and fats) are broken into simple end products with a release of energy. This process uses oxygen and produces carbon dioxide and water vapor. The respiration rate of a product determines its transit and postharvest life. Stored food reserves are lost during respiration, which means; less food value, loss of flavor, loss of salable weight, and more rapid deterioration. Respiration rates of commodities are directly related to product temperature; the higher the temperature, the higher the respiration rate. Rapid cooling to the commodity's lowest safe temperature is most critical for those with inherently higher respiration rates (see table below).

Temperature Management

For each 18°F increase above the optimum temperature for any given fruit, vegetable or flower, the rate of its deterioration doubles or triples. For example, the optimum temperatures for cabbage and sweetpotatoes, as presented in the tables in Horticulture Information Leaflet numbers 801 and 803, are 32°F and 55 °F, respectively.

Classification of Sample Horticultural Commodities According to Respiration Rates

Class	Commodity
Very low	Dried fruits, nuts
Low	Apples, garlic, grapes, onions, potatoes (mature), sweetpotatoes
Moderate	Apricots, cabbages, carrots, figs (fresh), lettuce, nectarines, peaches, pears, peppers, plums, potatoes (immature), tomatoes
High	Artichokes, brussels sprouts, cut flowers, green onions, snap beans
Extremely high	Asparagus, broccoli, mushrooms, peas, sweet corn

Temperature injuries – Temperature is the most significant environmental factor that influences the deterioration rate of harvested commodities. Fresh products exposed to extremes of heat or cold may sustain serious physiological damage, leading to rapid deterioration. Exposure to alternating cold and warm temperatures may result in moisture accumulation on the surface of commodities (sweating), which may enhance decay development.

Commodities exposed to direct sunlight or excessively high temperatures can be damaged. **Symptoms of heat injury include:** bleaching, surface burning or scalding, uneven ripening, excessive softening, and desiccation (water loss). For short term storage, higher-than-recommended temperatures may be satisfactory for some commodities.

Summary

Chilling injury occurs at temperatures above freezing in some commodities (especially those of tropical origin); including cucumbers, eggplant, okra, pumpkins and squashes, potatoes for processing, sweetpotatoes, and mature green tomatoes. **Recommended temperatures for these products** (tables in Horticulture Information Leaflet numbers 801 and 803) **should be adhered to strictly**. Some chill susceptible products can sometimes be held briefly at lower temperatures (non-freezing) without injury. However, keep in mind that chilling injuries are accumulative; the product of all the time a commodity is exposed to chill-inducing temperatures.

Symptoms of chilling injury include: pitting, surface decay (snap beans, cucumbers), internal browning (apples, sweetpotatoes), surface scald (eggplants), objectionable flavor (watermelons), watersoaking (tomatoes – ripe), poor color when ripe (tomatoes – mature-green), sweetening (potatoes), and hard when cooked (sweetpotatoes).

Proper Postharvest Temperature Management Recommendations:

- Harvest during the coolest times of the day; mornings are usually best.
- Keep harvested commodities and loaded vehicles in the shade to minimize heating.
- During transport, cover loaded vehicles with tarpaulins to minimize heating and sun injury.
- Grade, sort, and pack with TLC (Tender Loving Care).
- Thoroughly cool ASAP (as soon as possible).
- Maintain proper storage and/or transit temperature.
- Ship ASAP.
- Maintain proper display temperature (in retail store).

References: See Part V, Horticulture Information Leaflet No. 804.