

Grocery Store Display Storage¹

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Fresh produce items received at the grocery store are kept in storage rooms and/or display areas (in cabinets or cases or on racks or tables) for a few hours to a few days before they are purchased by consumers or removed by produce department personnel. During this time, the key factors in maintaining produce quality are careful handling to minimize mechanical injuries, storage and display within the optimum ranges of temperature and relative humidity, and proper sanitation of the storage and display areas. Expedited handling and effective rotation (first in, first out) of the products in the storage area are also recommended.

Storage room

The number and size of storage rooms depend upon store size and frequency of produce delivery to the grocery store. If 3 rooms are available for produce, they are best designated for short-term storage of the 3 groups of fruits and vegetables mentioned in the wholesale/distribution center storage section, i.e., #1 (0 to 2°C), #2 (7 to 10°C), and #3 (13 to 18°C). If only 2 rooms are available, one should be used for group #1 (0-2°C) and the other for groups #2 and 3 (with a compromise temperature range of 10 to 14°C). If only one room is available, it should be kept at a compromise temperature of 5°C and used for groups #1 and 2, while group #3 should be kept in an

air conditioned area. Cut flowers and other ornamentals that are best kept at 0 to 2°C can be combined with group #1 fruits and vegetables since ethylene production and action at this temperature range are minimal. Ornamentals that are chilling-sensitive and ethylene-sensitive should be handled in a separate area from the ethylene-producing fruits of group #3 to avoid ethylene damage.

All produce items should be near their optimum storage temperature when received at the grocery store and should be unloaded and moved quickly to their appropriate storage area. Keeping cold commodities at warmer temperatures for more than a few minutes can result in water condensation on the commodity, which may encourage subsequent incidence of decay due to growth of pathogens. Relative humidity should be kept within the optimum range (85% to 95% for most commodities) to minimize water loss. Good air circulation within the storage room is essential to proper product temperature and humidity maintenance. Thus, spaces should be kept among stacks or pallets of boxes and between them and the room walls. Introduction of fresh, ethylene-free air into the storage rooms should be enough to keep ethylene concentration below 1 ppm; preferably, it should be below 0.1 ppm if it can be done economically using fresh air exchanges and/or ethylene scrubbing systems.

Display fixtures

Most produce items in groups #1 and 2 should be displayed in refrigerated display cases. But for some commodities display at store ambient air temperature is acceptable; these include produce items that do not lose water quickly and have long shelf-life (like apples, pears, kiwifruits, and oranges) and produce on sale (special promotion) and are on display for a few hours (like grapes and strawberries).

Ideally, the display case temperature range should match the recommended range for each group of commodities, i.e., 0 to 2°C for group #1, including all fresh-cut products and 7 to 10°C for group #2. Since display cases usually do not have the refrigeration capacity to cool the products, it is important to assure that the product is near its recommended temperature when it is placed in the display case. The produce should not obstruct the discharge air and return air outlets to maintain good cold air circulation within the case. Also, the produce should not be stacked so densely that cold air circulation is blocked or so high out of the refrigerated zone that its temperature becomes closer to the ambient air temperature than to the display case cold air temperature.

Refrigerated display cases have either a horizontal or vertical air flow system and either a single-tier or multi-tier display shelves. They

should be equipped with easy to read, accurate thermometers, which should be calibrated and monitored regularly. Performance of refrigerated display cases is influenced primarily by their refrigeration capacity, defrost options, and air circulation system; secondary but important factors include temperature, relative humidity, and movement of surrounding air and radiant heat from the lighting sources.

A survey in 1989 of temperatures of fresh-cut salads kept in refrigerated display cases in a representative sample of grocery stores indicated an overall mean temperature of about 9°C with more than 78% having temperatures above about 7°C and more than 17.5% having temperature above about 13°C (R.W. Daniels, Audits International). A more recent survey of temperatures of fresh-cut vegetable products kept in refrigerated display cases in some grocery stores indicates an overall mean of about 5°C with more than 40% of the products

having temperature above about 7°C (Jeff Leshuk, Sensitech, Inc.). This indicates significant improvements in maintaining the cold chain within the grocery stores, but more improvements are needed to bring the temperature range for fresh-cut products close to the recommended 0 to 2°C.

Water loss reduction can be achieved by protecting the produce from excessive air movement, packaging in perforated polymeric films (as moisture barriers), periodic addition of sanitized, clean water by misting (of commodities that tolerate wetting, such as those listed in Table 1) and/or display on crushed ice (of products that tolerate direct contact with ice). If ice is used, proper drainage of the water resulting from ice melting should be provided. It should be remembered that ice is not an effective way to keep the product cold unless it is well surrounded by the ice.

Non-refrigerated display tables or racks are used for most group #3

fruits and vegetables, which should be displayed separately. Some of the fruits in groups #1 and 2 may be displayed on non-refrigerated display tables or racks at ambient produce department temperatures to enhance their ripening (such as avocado, kiwifruit, and pear). Day-light simulating fluorescent bulbs are good to provide adequate lighting without heat in the produce department.

During handling of fresh produce at the grocery store, all precautions should be taken to minimize potential chemical or microbial contamination to maintain safety of the produce. All display tables, cases, cabinets, and other fixtures much be cleaned and sanitized regularly. Unmarketable produce should be collected separate from the other waste products from the grocery store and used for composting.

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Table. 1 Produce which benefit from misting while displayed in refrigerated cases

Artichoke	Corn, Sweet	Peppers
Asparagus ¹	Eggplant	Radishes
Beans, snap	Endive	Rhubarb
Beets	Kale	Shallots, green
Broccoli	Leeks	Spinach
Brussels sprouts	Lettuce	Sprouts
Cabbage	Mustard greens	Squash, summer
Carrots	Onions, green	Swiss chard
Cauliflower	Parsley	Turnips
Celery	Parsnips	Watercress
Collards	Peas	

¹ Asparagus should be displayed vertically-oriented with cut ends on a wet absorbent pad