

# Grocery Store Display Storage

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**Introduction:** Fresh produce received at the grocery store are kept in storage rooms and/or display areas (in cabinets/cases or on racks/tables) for a few hours to a few days before purchased by consumers or removal by produce personnel. During this time, the key factors in maintaining quality are careful handling to minimize mechanical injuries, storage and display within optimum ranges of temperature and RH, and proper sanitation of storage and display areas. Expedited handling and effective rotation (first in, first out) of the produce is 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 three rooms are available for produce, they are best designated for short-term storage of the three groups of fruits and vegetables mentioned in the wholesale/distribution center storage section (see Wholesale Distribution Storage chapter), ie., No. 1 at 0 to 2 °C (32 to 35.6 °F), No. 2 at 7 to 10 °C (44.6 to 50 °F), and No. 3 at 13 to 18 °C (55.4 to 64.4 °F). If only two rooms are available, one should be used for group No. 1 at 0 to 2 °C (32 to 35.6 °F) and the other for groups No. 2 and No. 3 (with a compromise temperature range of 10 to 14 °C; 50 to 57.2 °F). If only one room is available, it should be kept at a compromise temperature of 5 °C (41 °F) and used for groups No. 1 and No. 2, while group No. 3 should be kept in an air conditioned area. Cut flowers and other ornamentals that are best kept at 0 to 2 °C (32 to 35.6 °F) can be combined with group No. 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 No. 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 the growth of decay producing pathogens. RH should be kept within the optimum range of 85 to 95% for most commodities to minimize water loss. Good air circulation within the storage room is essential to maintain proper product temperature and RH. Thus, space for air movement should be kept around stacks or pallets of boxes and between them and the room walls. Enough fresh, ethylene-free air should be introduced into storage rooms to keep ethylene < 1  $\mu\text{L L}^{-1}$  (1 ppm), and preferably < 0.1  $\mu\text{L L}^{-1}$  (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 No. 1 and No. 2 should be displayed in refrigerated display cases. Display at store ambient air temperature is acceptable for some commodities; including produce that does not lose water quickly and has a long shelf-life like apple, pear, kiwifruit, and orange. Produce that is on sale (special promotion) or will be on display for a few hours (like grapes and strawberries) can also be stored at ambient temperatures.

Ideally, the display case temperature range should match the recommended range for each group of commodities, ie., 0 to 2 °C (32 to 35.6 °F) for group No. 1, including all fresh-cut products and 7 to 10 °C (44.6 to 50 °F) for group No. 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, produce should not be stacked so densely that cold air circulation is blocked or so high that it is out of the refrigerated zone and becomes exposed to ambient air temperatures.

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. Important secondary factors include temperature, RH, and movement of surrounding air and radiant heat from the lighting sources.

A 1989 survey 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 (48.2 °F) with more than 78% having temperatures above about 7 °C (44.6 °F) and more than 17.5% having temperature above about 13 °C (55.4 °F) (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 (41 °F) with more than 40% of the products having temperature above about 7 °C (44.6 °F) (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 (32 to 35.6 °F).

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 (only useful for commodities that tolerate wetting, such as those listed in Table 1) and/or display on crushed ice (only useful for products that tolerate direct contact with ice). If ice is used, proper drainage of the melt water 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 No. 3 fruits and vegetables, which should be displayed separately. Some of the fruits in groups No. 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 at the grocery store, all precautions should be taken to minimize potential chemical or microbial contamination to maintain safety of 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 and used for composting.

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

Artichoke	Corn, sweet	Peppers
Asparagus <sup>1</sup>	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	

<sup>1</sup> Asparagus should be displayed vertically-oriented with cut ends on a wet absorbent pad.