

# Beet

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**Scientific Name and Introduction:** *Beta vulgaris* L. Crassa group, table beet or red beet is a biennial of the Chenopodiaceae family. In the first year, it forms a fleshy storage root (enlarged hypocotyl) that is the edible part. In the early stages of plant development, the whole plant may be consumed. They are grown worldwide, with leading production in Germany, Poland, Russian Federation, and North America.

**Quality Characteristics and Criteria:** Quality criteria include root shape, root size (diameter), color, firmness (turgidity), smoothness, cleanness, trimming of rootlets and freedom from defects. Intensive and uniform color with minimum zoning is the most important quality criteria.

**Horticultural Maturity Indices:** Fresh market bunched beets (with tops) are harvested as early as 50 to 70 days after planting whereas roots (without tops) are usually harvested later, but before they reach full maturity, especially when they are intended for long-term storage.

**Grades, Sizes and Packaging:** Grades U.S. No.1 and U.S. No.2 are based primarily on external appearance. Unless otherwise specified, the diameter of each beet shall be not < 2.5 to 3.8 cm (1 to 1.5 in). Standard bunches of beets shall be fairly uniform in size, and each bunch of beets shall not weigh < 0.5 kg (1.1 lb) and must contain at least 3 beets. Fresh market bunched beets are packed in small crates 10 to 15 kg (22 to 33 lb) capacity, whereas beets intended for storage are packed in 20 kg (44 lb) polyethylene lined crates or bins of 500 to 600 kg (1,100 to 1,320 lb) capacity

**Pre-cooling conditions:** Bunched beets should be pre-cooled to below 4 °C (39.2 °F) within 4 to 6 h of harvest. Hydro-cooling, forced-air cooling and package icing are common cooling methods. Proper pre-cooling and packaging retard subsequent discoloration of the leaves, weight loss and decay. Mature harvested beets should be pre-cooled within 24 h after harvest to below 5 °C (41 °F) with forced-air cooling.

**Optimum Storage Conditions:** Bunched beets can be kept for about 10 to 14 days at 0 °C (32 °F) and > 98% RH. Topped beets should be stored at 1 to 2 °C (32.9 to 35.6 °F) and 98% RH. During storage at 0 to 1 °C (32 to 33.8 °F), more black spot and rot occur than at higher temperatures (Schouten and Schaik, 1980). Red beets can be in air-ventilated storage for 4 to 6 mo and in mechanical refrigerated storage for as long as 8 to 10 mo. Before storage, beets should be topped and sorted to remove all diseased or mechanically damaged roots. Large roots keep much better than small ones, because they shrivel more slowly.

Red beets can be stored in pits and trenches, especially in those countries where Winter temperatures are low for prolonged period. Insulation of pits (clamps) and trenches is needed to avoid injurious temperature fluctuations. The temperature in pits (clamps) and cellars should not drop below -0.5 °C (31.1 °F) or exceed 5 °C (41 °F), to minimize losses caused by freezing or sprouting and rotting.

**Controlled Atmosphere (CA) Considerations:** There is little or no benefit from CA or MA storage of beetroots. Elevated levels of CO<sub>2</sub> (> 5%) in the atmosphere may cause increased decay (Shipway, 1968).

**Retail Outlet Display Considerations:** Bunched beets should be placed on refrigerated shelves at 3 to 5 °C (37.4 to 41 °F), and beetroots should be held < 10 °C (50 °F).

**Chilling Sensitivity:** Beetroots are not sensitive to chilling temperatures and should be stored as cold as possible without freezing.

**Ethylene Production and Sensitivity:** Beetroots produce very low amounts of ethylene at  $< 0.1 \mu\text{L kg}^{-1} \text{h}^{-1}$  and are not particularly sensitive to ethylene exposure.

**Respiration Rates:**

Temperature	mg CO <sub>2</sub> kg <sup>-1</sup> h <sup>-1</sup>
0 °C	4 to 6
5 °C	10 to 12
10 °C	16 to 20
15 °C	24 to 38
20 °C	50 to 70

To get mL kg<sup>-1</sup> h<sup>-1</sup>, divide the mg kg<sup>-1</sup> h<sup>-1</sup> rate by 2.0 at 0 °C (32 °F), 1.9 at 10 °C (50 °F), and 1.8 at 20 °C (68 °F). To calculate heat production, multiply mg kg<sup>-1</sup> h<sup>-1</sup> by 220 to get BTU per ton per day or by 61 to get kcal per metric ton per day. Data are from Uddin (1998).

**Physiological Disorders:** Death of shoots and breakdown of the top part of roots are a common problem during long-term storage of beetroots at 0 °C (32 °F). Physiological disorders will appear very quickly during subsequent shelf-life at 20 °C (68 °F) (Adamicki and Badełek, 1997).

**Postharvest Pathology:** The most common decay found in beetroots during storage is gray mold (*Botrytis cinerea* Pers.) (Robak and Wiech, 1998). Beetroots are also affected by black rot caused by *Phoma betae* Frank. Water-soaked and brown lesions become black and affect mostly the tip of the root. Good air circulation and optimal storage conditions retard development of black rot.

**Quarantine Issues:** None.

**Suitability as Fresh-cut Product:** No current potential.

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