

Rutabaga

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Scientific Name and Introduction: Rutabaga (*Brassica napus* L.; Napobrassica group), also referred as swedes, Swedish turnips, and turnip-rooted cabbage, is a member of the Cruciferae. The edible portion is the large, usually yellow-fleshed storage root. The three main commercial varieties of rutabagas include American Purple Top, Laurentian, and the Thomson Strain of Laurentian. Rutabaga is a cool season vegetable that withstands frost and mild freezing. In North America, rutabaga is primarily grown in Canada, California, Colorado, Wisconsin and Minnesota.

Quality Characteristics and Criteria: A high quality rutabaga is a well-shaped, purple-top root that has a smooth, small neck, and a well-defined taproot with a minimum of side roots, and is free of blemishes and bruises. The roots should be firm, fresh looking, sweet and not bitter, and heavy for their size. Lightweight rutabagas may be “woody” (Gardner and Nonnecke, 1987).

Horticultural Maturity Indices: Rutabagas should be harvested when fully mature, since immature rutabagas can have a bitter taste. Good quality rutabagas are harvested when maximum sugar accumulation has occurred. Winter crops should be harvested before weather becomes hot, or roots become pithy and woody. Harvesting Fall crops after the first frost can sweeten flavor (Suzuchi and Cutcliffe, 1981).

Grades, Sizes and Packaging: Grades include U.S. No. 1 and U.S. No. 2, based on subjective external appearance. Sizes are defined as Small, (diameter of 5.1 to 10.2 cm; 2 to 4 in); Small-Medium (8.9 to 14 cm; 3.5 to 5.5 in); Medium (10.2 to 15.2 cm; 4 to 6 in); and Large (13 to 17.8 cm; 5 to 7 in). Common packaging is 23 kg (50 lb) bushel cartons or bags (about 20 roots) and 11 kg (25 lb) 0.5-bushel cartons (about 10 roots).

Pre-cooling Conditions: Roots should be cooled as quickly as possible in order to avoid excessive moisture loss. Brown surface discoloration called ‘storage burn’ can be largely controlled by rapid cooling at 0 °C (32 °F) together with adequate air circulation (Franklin and Loughheed, 1975). If harvested when the soil or air is above 25 °C (77 °F), they should be cooled within 3 to 4 h to avoid loss of quality during storage. Room-cooling is most commonly used, however, forced-air cooling, hydro-cooling and package-icing can also be used to retard development of skin discoloration, weight loss and decay.

Optimum Storage Conditions: Rutabagas can be kept for 4 to 6 mo at 0 °C (32 °F) with 98 to 100% RH (van den Berg and Lentz, 1973). They should be stored unwrapped, in a cool, moist, dark area with good ventilation. If held 6 mo at 2 °C (36 °F) with 95% RH or 5 °C (41 °F) with 90% RH, weight loss can be as high as 6 and 11%, respectively (Cutcliffe and Anderson, 1989). Rutabagas for immediate marketing are often waxed to enhance appearance and protect against excessive moisture loss. Waxed roots will keep well under refrigerated conditions for 1 to 2 mo. Roots for long-term storage should not be waxed, since wax coatings become unsightly during storage and it may impede adequate gas exchange.

Controlled Atmosphere (CA) Considerations: There are no indications that rutabagas stored in CA have superior quality or longer shelf-life than roots stored at normal atmosphere at 0 °C (32 °F) with high RH (Franklin and Loughheed, 1975; Tomkins, 1959). Furthermore, CO₂ > 8% is injurious to rutabagas.

Retail Outlet Display Considerations: Rutabagas should be held in a refrigerated display. Use of top ice is accepted; misting is not recommended.

Chilling Sensitivity: Rutabagas are not sensitive to chilling, and should be stored as cold as possible. They can stand slight freezing without injury.

Ethylene Production and Sensitivity: Rutabagas produce very low amounts of ethylene at $< 0.1 \mu\text{L kg}^{-1} \text{h}^{-1}$ at 20°C (68°F); exposure to ethylene is not an important factor.

Respiration Rates:

Temperature	$\text{mg CO}_2 \text{ kg}^{-1} \text{ h}^{-1}$
0°C	4 to 6
5°C	8 to 12
10°C	9.5 to 19
15°C	20 to 31
20°C	34 to 40

To get $\text{mL kg}^{-1} \text{h}^{-1}$, divide the $\text{mg kg}^{-1} \text{h}^{-1}$ 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 $\text{mg kg}^{-1} \text{h}^{-1}$ by 220 to get BTU per ton per day or by 61 to get kcal per metric ton per day. Data are from the International Institute of Refrigeration (1967).

Physiological Disorders: Rutabagas freeze at about -1°C (30°F), and freezing may be initiated at -0.5°C (31°F). Symptoms include small, water-soaked spots on the surface and light browning of the flesh. Injured tissue appears tan or gray and gives off a fermented odor.

Brown heart or water-core of rutabagas is due to boron deficiency. Stored roots with brown heart may suffer tissue breakdown and moisture loss, thus becoming spongy; they may also develop brown spots and cracks (Ryall and Lipton, 1983).

Postharvest Pathology: Rot diseases are promoted by storage at higher than recommended temperatures. Brown soft rot caused by *Botrytis cinerea* is a major pathogen. Mold growth typically began at sites of tissue damage and then spreads to adjacent roots creating a dense surface growth of mycelium and conidia. Black rot caused by *Phoma lingam* causes restricted dry, corky, dark brown or blackish lesions with a sparse superficial growth of white mycelium. *Phoma* lesions can occur both at cut surfaces, where discoloration frequently spread into the vascular tissue, and as small craters on undamaged skin (Geeson et al., 1989). Bacterial soft rot caused by *Erwinia carotovora* has also been associated with postharvest deterioration of roots during storage (Shattuck and Proudfoot, 1990).

Quarantine Issues: Rutabagas must be completely free of soil because many plant pests are soil-borne. A Permit to Import rutabagas into Canada is required for areas of New York State (because of the possible presence of Golden Nematode, *Heterodera rostochiensis*), off-continent U.S. and all other countries.

Suitability as Fresh-cut Product: Rutabagas are good candidates for sale in consumer size packages. Pre-peeled rutabagas packaged in consumer film bags keep in good conditions for 3 weeks at 0°C (32°F). Fresh-cut rutabagas stored in 15% O_2 will keep for 10 days at 10°C (50°F) and 20 days at 1°C (34°F). Fermentation may occur at lower O_2 (Alexander and Francis, 1964). Storage of cubed, shredded, or peeled rutabaga in 5% O_2 + 5% CO_2 at 0 to 5°C (32 to 41°F) reduces respiration rate and has a moderate potential for benefit (Gorny, 1997).

Special Considerations: Strong odors may be transferred to fruits and leafy vegetables if they are held in the same storage area with rutabagas.

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