

Breadfruit

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Scientific Name and Introduction: The tropical breadfruit (*Artocarpus altilis* [Parkins] Fosb.) develops from the whole inflorescence and is normally round, sometimes cylindrical, 15 to 30 cm (6 to 12 in) in diameter and weighs from 0.5 to 3 kg (1.1 to 6.6 lb) (Nakasone and Paull, 1998). The fruit receptacle (core) is surrounded by a pale yellow-white edible pulp which is covered by a yellow green thin reticulated skin. Most varieties are seedless (Ragone, 1991); seeded varieties have from 10 to 150, 2.5 cm (1 in)-long brown seeds (Bennett and Nozzolillo, 1987). They are widely grown in tropical areas.

Quality Characteristics and Criteria: Fruit must be physiologically mature, have green skin and firm flesh with uniform shape, and be free from decay, sunscald, cracks, bruises, and mechanical damage.

Horticultural Maturity Indices: Fruit at different growth stages are harvested for different uses. Mature green fruit are harvested as a starch vegetable, while some people prefer to eat the ripe sweet fruit. Harvested green fruit produce copious latex, especially from the cut peduncle and injuries on the fruit. Maturity is indicated by larger size, a slight change in the skin color to a yellowish-green, small drops of latex on the rind, firm flesh texture and the segments are more rounded and smoother than less mature fruit. As the fruit starts to ripen, the skin changes to a yellowish green. Latex needs to be allowed to drain from the fruit after harvest before washing in water to avoid latex stain.

Grades, Sizes and Packaging: There are no U.S. or International grade standards. Graded according to size, various counts per fibreboard carton 9 to 18 kg (20 to 40 lb). Fruit sold on a weight basis. Telescoping 2-piece fibreboard cartons are generally used for packaging. Also, 1-piece cartons having dividers to minimize fruit movement and rubbing are used.

Pre-cooling Conditions: Cool and ship fruit as soon as possible after harvest. Room-cooling is generally used to 12 °C (53.6 °F), do not use hydro-cooling as it leads to skin browning.

Optimum Storage Conditions: Store at 12 to 14 °C (53.6 to 57.2 °F) and 90 to 95% RH for a maximum of about 20 days.

Controlled Atmosphere (CA) Considerations: Film wrapping delays softening and skin discoloration of breadfruit stored at 13 °C (55.4 °F) (Thompson et al., 1974). The O₂ levels in film wrapped fruit are less than 5% (Worrell and Carrington, 1997), while CO₂ rose to 10 to 30%. CA studies indicated that at 12 °C (53.6 °F), the best storage atmosphere is 2 to 5% O₂ + 5% CO₂ for up to 3 weeks storage (Ramlochan, 1991).

Retail Outlet Display Considerations: Display at 12 to 14 °C (53.6 to 57.2 °F); do not mist.

Chilling Sensitivity: Long term storage is not possible. At 12 °C (53.6 °F) chilling injury symptoms begin to develop within 7 days (Marriott et al., 1979). Symptoms are a brown scald-like discoloration of the skin, failure to fully soften, poor flavor development and an increase in decay.

Ethylene Production and Sensitivity: Early-maturing fruit have a production rate of 1.0 to 1.5 μL kg⁻¹ h⁻¹ and 0.7 to 1.2 μL kg⁻¹ h⁻¹ for late mature fruit (Worrell and Carrington, 1997). Breadfruit are sensitive to ethylene exposure, which leads to rapid ripening.

Respiration Rates:

Temperature	mg CO ₂ kg ⁻¹ h ⁻¹
13 °C	94 to 564
25 °C	362 to 597

To get mL kg⁻¹ h⁻¹, divide the mg kg⁻¹ 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 mg kg⁻¹ h⁻¹ by 220 to get BTU per ton per day or by 61 to get kcal per metric ton per day. From Worrell and Carrington (1997) and Worrell et al. (1998).

Physiological Disorders: Mechanical injury leads to rapid deterioration, possibly due to wound ethylene inducing premature and more rapid ripening. No other reported disorders (Worrell and Carrington, 1997).

Postharvest Pathology: Fruit rot due to *Phytophthora palmivora* and pink disease (*Botryobasidium salmonicola*) have been reported (Salunke and Desai, 1984). Purselove (1968) reports a fruit rot caused by *Rhizopus artocarpi* in India.

Quarantine Issues: Breadfruit is a fruit fly host and has been successfully treated by vapor heat treatment and irradiation.

Suitability as Fresh-cut Product: No products have yet been developed.

Special Considerations: Fruit can be boiled, dried, used in breadmaking or fermented, while slices can be fried or stored in brine (Whitney, 1988; Bates et al., 1991). The sweet ripe fruit is eaten as a dessert. The cooked seeds are also eaten.

References:

- Bates, R.P., H.D. Graham, R.F. Matthews, and L.R. Clos. 1991. Breadfruit chips: Preparation, stability, and acceptability. *J. Food Sci.* 56:1608-1610.
- Bennett, F.D. and C. Nozzolillo. 1987. How many seeds in a seeded breadfruit. *Econ. Bot.* 41:370-374.
- Marriot, J., C. Perkins and B.D. Been. 1979. Some factors affecting the storage of fresh breadfruit. *Sci. Hort.* 10:177-181.
- Nakasone, H.Y. and R.E. Paull. 1998. Tropical fruits. CAB Intl., Wallingford UK, 445 pp.
- Purselove, J.W. 1968. Tropical crops – Dicotyledons. Longman, London, pp. 379-384.
- Ragone, D. 1991. Ethnobotany of breadfruit in Polynesia. In: P.A. Cox and S.A. Banack (eds) Islands, Plants, and Polynesians - An introduction to Polynesian Ethnobotany, Dioscorides Press, Portland OR, pp. 203-220.
- Ramlochan, R. 1991. Transient cooling and storage of breadfruit in refrigerated and controlled atmosphere environment. Thesis, University of the West Indies, St. Augustine, Trinidad. Cited in Worrell and Carrington (1997).
- Salunke, D.K. and B.B. Desai. 1984. Postharvest biotechnology of fruits. Vol II. CRC Press, Boca Raton FL, pp. 127-128.
- Thompson, A.K., B.O. Been, and C. Perkins. 1974. Storage of fresh breadfruit. *Trop. Agric.* 51:407-415.
- Whitney, P.J. 1988. The microbiology of breadfruit and Cassava preservation by pit fermentation. *Trop. Sci.* 28:43-50.
- Worrell, D.B., C.M. Carrington. 1997. Breadfruit. In: S.K. Mitra. ed. Postharvest Physiology and Storage of Tropical and Subtropical Fruits. CAB Intl., Wallingford UK, pp. 347-363.
- Worrell, D.B., C.M. Carrington and D.J. Huber. 1998. Growth, maturation and ripening of breadfruit, *Artocarpus altilis* (Park.) Fosb. *Sci. Hort.* 76:17-28.