

Coconut

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Scientific Name and Introduction: Coconut (*Cocos nucifera* L.) is marketed at two stages of development. At an immature stage, the fruit (water coconut) contains mainly water and a little jelly-like meat instead of the hard white flesh (meat - endosperm) found in mature coconuts. In Thailand, and now marketed in the US, immature green nuts are trimmed and shaped, removing most of the husk. The final product has a flat bottom, round body with a pyramid top and the eyes showing. To prevent browning of the remaining husk, nuts are dipped in 1 to 3% sodium meta-bisulfite for 2 to 5 min and then wrapped in plastic film (Tongdee et al., 1991). Sometimes fungicide is included in the sulfite solution. Alternatively, the husk is removed before dipping in sulfite solution. Fruit are available year-round from most tropical countries (Seelig, 1970).

Quality Characteristics and Criteria: Maturity, size, freedom from blemishes, cracking, freedom from fiber of husked coconuts, and wet or moldy eyes are major quality characteristics. Check for a sloshing sound for presence of coconut water in the nut. Coconut milk is obtained by removing and grating the hard white flesh and squeezing out the milky juice. Immature, de-husked coconuts are about 10 cm (4 in) in diameter, weigh about 500 g (1.1 lb), have 100 g (3.5 oz) endosperm, 120 g (4.2 oz) shell and 250 g (8.8 oz) water.

Horticultural Maturity Indices: Young coconuts are harvested 6 to 9 mo after flowering, as the nut approaches full size and the skin is still green (Consignado et al., 1976; Srivichai, 1997) and the short stem (rachillae) on the top of individual coconuts that originally held the male flowers (in Thai called 'rat-tail') becomes half green and brown. In immature nuts, the skin surface around the calyx (cap) on the top of coconuts is creamy-white or a whitish-yellow. When the area surrounding the cap is green the coconut is regarded as mature and is 10 to 12 mo old. At maturity the skin begins to change from green to yellow then brown and the 'rat-tail' is entirely brown.

Grades, Sizes and Packaging: No specific grades, informal grades usually based on size and weight. Mature US de-husked coconuts are sold in 34 to 36 kg (75 to 80 lb) woven plastic or burlap sacks containing 40 to 50 coconuts, plastic mesh bags of 12 coconuts or cartons with 20 to 25 film wrapped coconuts, 17 to 18 kg (37 to 40 lbs). Immature coconuts (water coconut) After the husked immature coconuts are shaped, dipped in bisulphate, and film wrapped, they are sold in single piece cartons containing 10 to 16 nuts. For young coconuts, the entire husk is removed and they are then dipped in sodium bisulfite before packing.

Pre-cooling Conditions: Room-cooling is generally used for mature husked nuts. Forced-air and hydro-cooling are acceptable. A rapid temperature change of 8 °C (14.4 °F) can cause cracking.

Optimum Storage Conditions: Mature coconuts with husk can be kept at ambient conditions for 3 to 5 mo before the liquid endosperm has evaporated, the shell has cracked because of desiccation or sprouting has occurred. Storage at 0 to 1.5 °C (32 to 35 °F) and 75 to 85% RH is possible for up to 60 days for mature, dehusked coconuts (Maliyar and Marar, 1963) and 13 to 16 °C (55 to 60 °F) and 80 to 85% RH for 2 weeks or less. Low RH and high temperature should be avoided.

Young coconuts are normally held at 3 to 6 °C (37 to 43 °F) with 90 to 95% RH, while wrapped shaped fruit can be held for 3 to 4 weeks. Shaped young coconuts treated with 0.5 to 1.0% sodium meta-bisulfite, can be held at ambient temperature for 2 days before browning occurred, while those treated with 2%

sodium meta-bisulfite can be held at ambient temperature for 2 to 7 days (Tongdee et al., 1992). Young coconuts that have not been dehusked can be stored for a longer period than de-husked or shaped young coconut. In de-husked or shaped coconut, SSC declines and TA increases more rapidly than in non-dehusked coconut, subsequently the taste of dehusked or shaped coconuts sours earlier than non-dehusked during storage (Somboonsup, 1985). The husk acts as insulator and may increase the storage-life of young coconuts.

Controlled Atmospheres (CA) Consideration: No data are available on CA storage. Mature dehusked coconuts are waxed or film-wrapped to reduce water loss. Immature husked nuts can also be film-wrapped or waxed, however the outside color changes rapidly from white to brown unless dipped into sodium bisulfite (Tongdee et al., 1992).

Retail Outlet Display Considerations: Display at ambient temperature and do not mist. Non-wrapped or individually-wrapped shaped coconuts are displayed at ambient temperature or 10 °C (50 °F). Sometimes, 5 to 10 shaped coconuts are placed in perforated polyethylene bags and sold in Thai retail markets.

Chilling Sensitivity: When stored at 0 °C (32 °F), immature nuts have green skins that turn brown after 7 days; few other changes occur in other quality characteristics at this temperature (Consignado et al., 1976).

Ethylene Production and Sensitivity: Very low to near zero for mature husked coconut. There are no reports of sensitivity to ethylene.

Respiration Rates: Mature husked coconuts respire at 45 to 55 mg CO₂ kg⁻¹ h⁻¹ at 25 °C (77 °F). This is equivalent to about 26 to 32 μL CO₂ kg⁻¹ h⁻¹. To calculate heat production, multiply mg CO₂ kg⁻¹ h⁻¹ by 220 to get BTU per ton per day or by 61 to get kcal per metric ton per day.

Physiological Disorders: Mechanical damage to immature coconut will cause the white coir to turn brown and can cause nut cracking. Younger nuts have a lower rupture force than mature nuts (Tongdee, 1991). A rapid temperature change of 8°C (15 °F) during storage of mature husked coconut can lead to cracking (Burton, 1982), while freezing occurs at -3 °C (26.6 °F). Moisture loss causes a loss of water in the nut that can be reduced by RH control, film wrapping or waxing mature nuts.

Postharvest Pathology: Superficial mold growth does occur on wet coconuts.

Quarantine Issues: None, if mature, free of surface insects and soil, and the husk is dry. Some restrictions exist on the importation into certain tropical and subtropical areas from countries having diseases that may impact local palms.

Suitability as Fresh-cut Product: Meat from both immature (jelly-like) and mature (hard) is sold in trays with over-wrap or plastic bags for use in deserts. Immature coconut jelly-like meat and coconut water have to be held at 3 to 5 °C (37 to 41 °F) to avoid spoilage. Small plastic bags with the jelly like meat and water are frequently seen held on ice in South-East Asian Markets and at road-side stalls. For mature coconuts, non-shredded and shredded meat is packed in plastic bags for cooking and deserts.

Special Considerations: None.

References:

- Burton, B.D. 1982. Prevention of postharvest studies cracks in husked coconuts during transit. J. Amer. Soc. Hort. Sci. 107:905-907.
- Consignado, T.O., P.C. Tabora and R.P. Creencia. 1976. Physio-chemicals changes in stored young

- coconut. *The Phillipine Agriculturist* 60:256-270.
- Marar, M.M.K. and C.A. KurhIRaman. 1957. Studies on the keeping quality of ripe coconut in storage. *Coconut J.* 10(4):37-51.
- Muliyar, M.K. and M.M.K. Marar. 1963. Studies on the keeping quality of ripe coconuts in storage. *Indian Coconut J.* 17:13-18.
- Seelig, R.A. 1970. *Coconuts: Fruits and vegetable facts and pointers*. United Fresh Fruit and Vegetable Assoc., Wash. D.C.
- Somboonsup, S. 1985. Effect of some postharvest handling on quality of fresh coconuts. Undergraduate Special Project. Dept. Hort., Kasetsart Univ., Bangkok. 18 pp. (In Thai)
- Srivichai, S. 1997. *Planting Coconut Palm*. Agric. Com. Pub., Bangkok, Thailand, 95 pp. (In Thai)
- Tongdee, S.C. 1991. Postharvest handling of tender coconut. *ASEAN Food J.* 6:74-75.
- Tongdee, S.C., A. Suwanagul and S. Neamprem. 1992. Control of browning in trimmed green coconuts. In: *ACIAR Project 8844, Wkshp Postharv. Hand. Trop. Fruit*. Bangkok, Thailand, pp. 15.