Waterchestnut

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Scientific Name and Introduction: Waterchestnut or matai (*Eleocharis dulcis* (Burm.) Trin. ex Hens.) is a member of the sedge family (Cyperaceae). It is primarily cultivated throughout tropical Asia for its edible corms. The plant is a hydrophyte (water-loving) and is grown under flooded conditions similar to paddy rice. There are two types: sweet 'hon matai' and starchy 'sui matai,' with the former more popular in the U.S. *Eleocharis dulcis* corms differ from fruit of the dicot *Trapa* species (*T. bicornis and T. natans*) which are also called water chestnuts, in that they are toxic when eaten raw (Rubatzky and Yamaguchi, 1997).

Quality Characteristics and Criteria: High quality hon matai waterchestnuts are tender, crisp, and somewhat sweet with a white interior tissue. The corms may be eaten raw, but maintain their crispness when cooked and are usually consumed cooked.

Horticultural Maturity Indices: Corms mature after plant tops have died or been killed by frost. Mature corms are recognized by their well-developed, lignified, dark, shell-like epidermis. Corms keep well underground, and harvest can be delayed for up to 4 mo after tops senesce (Hodge, 1956). Sugar content is more than double in corms harvested in December versus October in the Southeastern U.S. (Twigg et al., 1957). However, corms became less tender and more fibrous when harvest is delayed (Brecht et al. 1992).

Grades, Sizes and Packaging: There are no USDA grade standards. However, mature corms, dark-skinned, and over 30 mm (1.25 in) in diameter with no physical injury from harvesting are considered marketable (DeRigo and Winters, 1964), but corms over 40 mm (1.5 in) in diameter are more desirable (McGregor, 1989). Corms are usually packed and stored in film bags with moist sphagnum moss.

Pre-Cooling Conditions: Although amenable to faster cooling methods such as hydro-cooling and forced-air cooling, waterchestnuts are usually room-cooled for storage and prior to shipping. Immersion in cold, chlorinated water (see below) may be an effective pre-cooling treatment.

Optimum Storage Conditions: When stored and packed in moist sphagnum moss, waterchestnuts can be stored for 1 to 2 mo at 0 to 2 °C (32 to 36 °F) with 98 to 100% RH (Ryall and Lipton, 1979). They can be stored at least 10 mo at 0 °C (32 °F) and 8 mo at 5 °C (41 °F) if corms are free from damage and submerged in NaOCl solution soon after harvest. An initial concentration of about 1,000 µL L^{-1} falls to essentially zero within 3 to 5 days. Anaerobiosis was not a problem when 23 kg (50 lb) lots were stored in open containers with the solution 60 cm (24 in) deep (Kanes and Vines, 1977). However, the storage-life of mechanically harvested corms was < 2 mo in either aerated water or 1,000 µL L^{-1} NaOCl at 1.5 °C (34.7 °F) (Kays and Sanchez, 1984).

Controlled Atmosphere (CA) Considerations: There is no information on the use of CA.

Retail Outlet Display Considerations: Waterchestnuts should be displayed in refrigerated units with water spray or mist to keep them from shriveling.

Chilling Sensitivity: Chilling injury is only a concern with immature corms. Symptoms are watersoaking, internal browning, and external decay. Immature corms can become injured within 10 days at 1 °C (34 °F), and by 21 days, shrivel and become discolored (Brecht et al., 1992).

Ethylene Production and Sensitivity: There is no information on ethylene production or ethylene sensitivity of waterchestnuts.

Respiration Rates:

Temperature	mg CO_2 kg^{-1} h^{-1}
0 °C	10.1
5 °C	25.4
10 °C	41.6
15 °C	78.7 (estimated by extrapolation)
20 °C	114.4

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. Data are from Peiris et al., 1997.

Physiological Disorders: Damaged areas on corms turn brown, which detracts from their appearance and must be trimmed when the corms are peeled. They are susceptible to water loss, which causes loss of crispness and tenderness, but texture changes are minimal in refrigerated storage if water loss is minimized (Kays and Sanchez, 1984; Brecht et al., 1992).

Postharvest Pathology: Decay, mainly due to *Fusarium* and *Geotrichum* spp., was a problem at storage temperatures > 5 °C (41 °F) and in immature corms with chilling injury (Brecht et al., 1992). Black rot (*Cerastomella paradoxa*) and Trichoderma rot (*Trichoderma viride*) have been reported, with Black rot being controlled by curing at 30 to 32 °C (86 to 90 °F) with 100% RH for 3 days (Ryall and Lipton, 1979).

Quarantine Issues: None.

Suitability as Fresh-cut Product: Fresh, peeled corms could be marketed if consumer demand is sufficient. A method has been developed to mechanically peel waterchestnut corms that involves cutting off the apical and basal ends, removing the peel with hot alkali followed by wet brushing, and bleaching with hydrogen peroxide (Leeper and Williams, 1976).

Special Considerations: Following washing with water to remove adhering soil, corms should be treated with chlorinated water (1,000 µL L^{-1}; pH 7.0) to reduce decay. Waterchestnuts sweeten during low temperature storage, much like potato (*Solanum tuberosum* L.) tubers and parsnip (*Pastinaca sativa* L.) roots (DeRigo and Winters, 1964). Starch to sugar conversion can result in doubling or tripling of sugar levels within 1 mo of storage, with no further increase over longer storage times; maximum sugar levels are reached at 10 °C (50 °F) and in early-harvested, larger corms (Brecht et al., 1992), but decay can limit storage at 10 °C (50 °F) to 1 mo.

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