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Durian: Postharvest Quality-Maintenance Guidelines

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The durian is often referred to as the "King of Fruits" in Southeast Asia. However, its qualities promote considerable discussion because of its odor, a strong onion–garlic aroma, which is offensive to some. The genus specification *zibethinus* is derived from the Italian "zibetto," or civet, a cat-like animal with a musky smell.

Durian
Durio zibethinus Murray
(Syn. D. acuminatissina Merr)

This tropical tree is mainly cultivated in Sri Lanka, southern India, southern Burma, Thailand, Cambodia, Vietnam, Malaysia, Indonesia, Borneo, Mindanao (Philippines), and New Guinea. It has been spread throughout the tropical world, with the general name of durian (Indo-Malay) or variants thereof, including duren (Indonesian), duyin (Burmese), thureen (Cambodian), thurian (Thai), saurieng (Vietnamese), dulian (Philippines), stinkvrucht (Dutch), and kadu (Sudan). Limited supplies are available from the Caribbean and Central and South America. Commercial supplies are available from Thailand and Malaysia.

Quality Characteristics and Criteria

The oval or ellipsoid green to brownish fruit weighing up to 8 kg (18 lb), can be up to 30 cm (12 in) long and 20 cm (8 in) in diameter, densely covered with stout sharp pyramidal spines (1 cm; 0.5 in) on a thick fibrous rind. Fruit are divided into 3 to 5 smooth-walled compartments, each containing one to six glossy, creamy to red-brown seeds 2 to 6 cm (0.8 to 2.4 in) long, covered by a white to yellowish soft sweet pulp (aril). The pulp can be odorless or have a strong odor suggesting garlic, onion, or strong cheese with a fruity background. The edible pulp (20 to 35% total mass) has a smooth, firm custard-like texture. In some fruit, seeds are rudimentary or small compared to larger seeds in wild types.

Quality criteria include a pulp with sweet flavor and a good texture, few or small seeds, large aril percentage and marketable weight of 1.5 to 3.5 kg (3.3 to 7.7 lb), elongated to round shape, good shelf-life, good rind color and thickness, reduced rind dehiscence, and freedom from disease and insects. Superior varieties have thick, yellow, fiberless, and firm pulp.

The Thai variety 'Chanee' has stronger aroma and is smaller than the preferred 'Monthong' (Golden Pillow). Malaysian varieties include; D-2 'Dato Nina', D-7 'Repok B-2', D-10 'Durian Hyan', D-24, and D-98 'Katoi'.

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Durian tied to a branch to prevent natural fruit fall.

Horticultural Maturity Indices

At maturity, the fruit naturally falls (abscises) from the tree at the articulation of the fruit stem with the fruit and then ripens in 2 to 4 days, with the fruit normally splitting into segments of irregular width at the stylar end. Ripening results in an increase in soluble sugars and a decrease in starch and pulp firmness, all of which occur before natural fruit splitting (dehiscence) starts.

To prevent natural fruit fall (abscising), fruit may be tied to the limb or harvested at maturity. Maturity is judged by appearance (fruit stalk thickness and flexibility, abscission zone, or carpel sutures), number of days from flowering, and a hollow sound when tapped with a wood or rattan stick or knife. Days from flowering and tapping are the most reliable criteria (Siriphanich 1996). 'Chanee' durian takes 2 to 4 days to ripen after harvest, while 'Monthong' durian takes 4 to 6 days, depending on maturity. Fruit at 85% maturity, based upon days from anthesis and rind characteristics, ripen to excellent quality in less than 1 week at 28 to 31°C (82.4 to 87.8°F). Ripening takes longer than 1 week at 22°C (71.6 °F). Fruit that are 95% mature when harvested have already commenced ripening, while 75% mature fruit may ripen with an inferior quality. Fruit collected from the ground after falling are more subject to disease and fracture and have a short shelf-life (2 to 3 days), instead of 7 to 8 days if picked from the tree. In Thailand, the fruit is harvested with the stem (peduncle) attached and the fruit stem is wrapped in a leaf or paper by retailers to reduce wilting and maintain the fresh appearance of the stem, whose appearance is also used as a measure of fruit freshness. 'Chanee' is at optimum eating stage for only a few days, while 'Mon Tong' is at this stage for a longer period.

Grades, Sizes, and Packaging

Fruit are graded on weight, shape, size, and defects (Nanthachai 1994). Defects include disease, insects, mechanical injury, and flesh disorders. The grades vary with variety (Hiranpradit et al. 1992). The fruit is packed into cardboard cartons (4 to 6 fruit per carton), or in cartons fitted with fiberboard dividers.

Pre-Cooling Conditions

Use forced-air or room-cooling to 15°C (59°F).

Optimum Storage Conditions

This climacteric fruit, when stored at 15°C (59°F), has extended shelf-life (Brooncherm and Siriphanich 1991); relative humidity of 85 to 95% is best (Sriyook et al. 1994, Ketsa and Pangkool 1994). Fruit can be waxed to reduce water loss (Sriyook et al. 1994). Fruit ripened at a lower relative humidity (75%) have a better eating quality and are less juicy and easier to dehusk than fruit ripened at higher relative humidity (Ketsa and Pangkool 1994).

Controlled Atmospheres (CA) Consideration

Ripening is inhibited by 2% O_2, and fruit fail to ripen when removed to air. Fruit stored in up to 20% CO_2 in air did not affect ripening or quality (Tongdee et al. 1990). Low O_2 (10%) reduces respiration rate and ethylene production but does not affect the onset of ripening, and ripe fruit quality is not affected. The aril remain hard in less mature fruit stored in 10% O_2 and 15 or 20% CO_2. The commercial potential of CA or MA is still unclear (Siriphanich 1996).

Retail Outlet Display Considerations

Display at ambient temperature or hold at 15 to 18°C (59 to 64.4°F) if possible. Do not mist or ice. Avoid mixing during storage with other produce. The husk can be removed and the whole pulp and seed segment can be removed and sold in trays with a plastic over-wrap. Remove husks as soon as durian produces aroma or is half-ripe and the pulp is still firm. If fruit splitting has started, the pulp is generally too soft and has a very short shelf-life.

Durian on sale.

Durian rot.

Chilling Sensitivity

The pulp of half- to near-full ripe fruit is much less sensitive to chilling injury than the peel, and the pulp can be stored for 4 weeks at 5°C (41°F). Whole fruit stored at less than 15°C (59°F) develops chilling injury consisting of the peel turning black or dark brown, starting at the groove between the splines (Brooncherm and Siriphanich 1991). Chill-injured pulp suffers a lose of aroma, does not soften, and may develop sunken areas on the surface (Siriphanich 1996).

Ethylene Production and Sensitivity

Production varies from near zero in immature fruit up to 40 Fl/kg·hr at the climacteric peak and varies with variety (Tongdee et al. 1987a). Most of the ethylene production is associated with the husk, as the pulp has a very low rate (Siriphanich 1996). Durian can be ripened with ethylene gas (Ketsa and Pangkool 1995) or ethephon (Atantee 1995). The husk of ripened durians will turn yellowish to brownish if the ethylene concentration is too high. Thai consumers prefer to buy naturally ripened durians, as the husk remains light green or olive, while durians with a yellowish or brownish husk are not regarded as fresh. In Thailand, many growers, wholesalers, and retailers ripen durians by a quick dip of the fruit stalk (peduncle) into an ethephon solution (3000 µL L-1 or higher). This approach saves on ethephon use and prevents development of yellowish or brownish husks. Ethephon use postharvest is not approved in the U.S.

Respiration Rates

Respiration rate is 80 to 450 mg (45 to 254 µL) CO_2 kg-1 h-1 at 22°C. 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. The peel has a much higher respiration rate and ethylene production than the pulp (Brooncherm and Siriphanich 1991). The climacteric rise seems to occur first in the pulp. For ‘Chanee’ and ‘Kan Yao’ the respiratory and ethylene peaks plateau or decline when the fruit is overripe, while in ‘Mon Tong’ the peak occurs when overripe (Tongdee et al. 1987b).

Physiological Disorders

Failure of the aril to soften or to soften unevenly is a frequently observed disorder. Another disorder leads to a watery aril with a flat and dull taste and occurs especially during the rainy season. The cause of both disorders is unknown (Nanthachai 1994).

Postharvest Pathology

Phytophthora spp. is a major cause of rot in immature and mature fruit that leads to high losses during rainy weather and when fruit come in contact with soil. Another major cause of fruit rot is *Lasiodiplodia* spp. (Tongdee et al. 1987a). Fruit on the ground can also be attacked by *Sclerotum rolfsii*. Fruit diseases due to *Phomopsis, Collectrichum, Fusarium,* and *Rhizopus* are sometimes severe (Siriphanich 1996). Sanitation, avoidance of mechanical injury, and fungicide can be used for control (Lim 1990).

Quarantine Issues

If the skin is not broken or split, durian is not a fruit fly host. The skin must be free of other insects such as scales.

Suitability as Fresh-Cut Product

The fruit is most frequently eaten fresh. The aril contains 64% water, 2.7% protein, 3.4% fat, 27.9% carbohydrate, and 23 mg/1000 g Vitamin C. Choice varieties demand and receive higher prices than other varieties. Roadside and market stalls may cut open the fruit and package the soft aril and seed in a shrink- or stretch-wrapped tray. Ripe fruit and soft arils are also frozen for export. Partially ripe fruit are difficult to open without damaging the pulp.

Special Considerations

Thailand is the largest producer, followed by Indonesia and peninsular Malaysia. The fruit is highly prized in the markets of Southeast Asia. Consumers in Singapore prefer fully ripe fruit with no splitting, while Thais prefer the firmer pulp of less ripe fruit with less volatiles. Others prefer the strong-flavored durian over the milder cultivars. There is a demand among ethnic groups familiar with the fruit in large temperate cities.

The pulp is dehydrated and sold as "durian cake," boiled with sugar, fermented, or salted. The dried aril is used as a flavoring in ice cream, confectionery, pastry, and soft drinks. Boiled or roasted seeds are eaten as snacks. Durian chips can be made from the immature and unripe durian pulp, as the lighter-colored flesh makes more attractive chips.

Do not ship with mixed loads.

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