Mangosteen

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Scientific Name and Introduction

Mangosteen (*Garcinia mangostana* L.) is one of the most praised of tropical fruit. It is also known as mangostanier, mangoustanier, mangouste, mangostier (French), mangostan (Spanish), manggis, mesetor, semetah, sementah (Malaysian), manggustan, mangis, mangostan (Philippine), mongkhut (Cambodian), mangkhut (Thai), cay mang cut (Vietnamese), manggis, manggistan (Dutch), and mangostao, mangosta, or mangusta (Portuguese) (Nakasone and Paull 1998).

The globe-shaped, smooth berry is 4 to 7 cm (1.6 to 2.8 in) across and has a persistent calyx. The pericarp is 6 to 10 mm (0.24 to 0.4 in) thick and turns purple during ripening. It contains a bitter, yellowish latex and purple-staining juice. The edible white aril has 4 to 8 segments with 1 or 2 larger segments containing apomictic seeds; there is no true seed.

Quality Characteristics and Criteria

Fruit have pinkish-red skin when mature, turning to a dark purple skin and white flesh. The skin should be thick and soft, but firm, when ripe. Fruit have a soft, sweet, slightly acid flesh with a pleasant flavor. Misshapen and damaged fruit should be removed. Burst latex vessels leave a yellow dried latex on the skin that should be scraped off, followed by washing the fruit with a soft brush. Fruit are graded to remove damaged fruit and for size. Some Thai growers and exporters coat cleaned fruit with lacquer, giving fruit skin damaged by thrips prior to harvest a more attractive appearance.

Horticultural Maturity Indices

Skin color is the major criterion used to judge maturity. Immature fruit that have a light, greenish-yellow skin with scattered pinkish spots do not ripen to full flavor if harvested. The minimum harvest stage for high quality fruit is when the skin has distinct irregular, pink-red spots over the whole surface. Fruit are at the edible, ripe stage when the skin has darkened to reddish-purple, no latex remains in the skin, and the flesh segments separate easily from the skin (Tongdee and Suwanagal 1989). Careful handling is essential in order to avoid mechanical injury.

Grades, Sizes, and Packaging

There are no U.S. or international standards. Fruit are graded by size and color. Mangosteens are normally sold in single-layer, fiberboard cartons holding 2.25 kg (5 lb) with padding, or sometimes in trays with fruit individually wrapped to prevent injury (20 to 24 fruit per tray). In Southeast Asia, fruit are sold in baskets or strung in bundles of 10 to 25 fruit.

Precooling Conditions

Room-cooling is normally used (Augustin and Azudin 1986).

Optimum Storage Conditions

Recommendations vary from 4 to 6 °C (39 to 42 °F) with 85 to 90% RH for 7 weeks (Pantastico 1975) to 13 °C (56 °F) with 85 to 90% RH for 14 to 25 days. Storage at 4 °C (39 °F) or 8 °C (46 °F) can lead to significant hardening of the skin (Augustin and Azudin 1986), though the flesh may still be acceptable after 44 days. Current practice is to store fruit at 12 to 14 °C (54 to 57 °F), giving storage life of about 20 days without chilling injury. Application of surface coatings reduces weight loss and prevents calyx wilting (Choehom 1997).

Controlled Atmosphere (CA) Considerations

An atmosphere of 5% O_2 and 5% CO_2 has been used for 1 mo (Yahia 1998) and resulted in best overall retention of peel appearance and internal quality (Rattanachinnakorn et al. 1996). Holding fruit in polyethylene film bags reduces weight loss and disease (Daryono and Sabari 1986); however, it is not clear if the effects are due to the prevention of water loss or to the modified atmosphere in the bags.

Retail Outlet Display Considerations

Fruit are commonly displayed in overwrapped trays or in closed styrene, clam-shell containers with no perforations at 10 to 14 °C (50 to 57 °F). They should not be misted.

Chilling Sensitivity

Storage at <10 °C (50 °F) leads to rapid hardening and darkening of pericarp when fruit are returned to ambient temperature (Uthairatanakij and Ketsa 1996, Choehom 1997).

Ethylene Production and Sensitivity

Mangosteen is a climacteric fruit. Ethylene production is about 29 nL kg^{-1} h^{-1}. The respiratory peak occurs sooner when fruit are treated with ethylene. Ethylene treatment triggers autocatalytic ethylene production (Noichinda 1992).

Respiration Rates

Respiration rate is 21 mg (12 µL) CO_2 kg^{-1} h^{-1} at 25 °C. Heat production is 4,620 BTU ton^{-1} day^{-1} (1,281 kcal $tonne^{-1}$ day^{-1}).

Physiological Disorders

Fruit damage during harvesting and marketing can affect >20% of fruit. The “gamboges”

disorder occurs where latex seeps into the flesh (aril), turning it yellow and giving it a bitter taste. “Gamboges” also moves onto the outer surface of the fruit. This is a preharvest disorder of unknown cause that makes it difficult to separate the aril from the surrounding tissue, even in ripe fruit; it causes hardening of the pericarp. This should not be confused with impact injury that leads to hardening of the pericarp at the point of impact and aril collapse, dehydration, pink color development, or browning (Tongdee and Suwanagul 1989). A drop of 10 cm can cause slight pericarp damage, indicated as hardening at the point of impact within 24 h. Higher drops causing significantly greater damage often lead to downgrading of the fruit (Tongdee and Suwanagul 1989, Ketsa and Atantee 1998).

Another disorder of mangosteen fruit is translucent aril *(nue-kaew),* believed to be induced by heavy rain during fruit growth and development, even if just before harvest (Laywisakul 1994). The specific gravity of fruit with translucent aril is >1.0, while that of normal aril is <1.0. This allows separation of fruit by floating them in water (Podee 1998). Fruit with translucent aril have lower SSC and TA than normal fruit (Pankasemsuk et al. 1996).

Postharvest Pathology

Botryodiplodia theobromae, Diplodia spp., *Pestalotia flagisettula, Phomopsis* spp., and *Rhizopus* spp. have been reported; they harden the skin and decay the aril.

Quarantine Issues

Mangosteen is a fruit fly host. Irradiation at 300 grays has potential for disinfestation. Alternatively, harvested fruit are carefully cut open and the aril inspected; fruit are then frozen whole and shipped.

Suitability as Fresh-Cut Product

Some potential exists.

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