Mango

Robert E. Paull and Ching Cheng Chen
Paull and Chen are with the Department of Tropical Plant and Soil Sciences, University of Hawaii at Manoa, Honolulu, HI.

Scientific Name and Introduction

Mango (*Mangifera indica* L.) is cultivated throughout the tropics and warmer subtropics. Of the numerous varieties, Florida's 'Tommy Atkins,' 'Kent,' 'Keitt,' and 'Haden' are the most common in the United States. The fruit's skin is yellow or green with a golden to red blush, depending on the variety. Fruit can be round, oval, or kidney shaped. Some varieties have a turpentine-like smell and taste.

Quality Characteristics and Criteria

Skin coloration, size, appropriate shape for the variety, appearance, freedom from defects and decay, absence of fiber in the flesh, and a turpentine-like flavor are the most common quality parameters. Wilted, grayish discoloration and pitting are undesirable. Some fruit varieties ('Haden') have pinhead-sized black spotting that is not regarded as a defect.

Horticultural Maturity Indices

The general criteria for maturity of most cultivars of mango are (1) the fruit "shoulders" have risen above the stem-end and (2) there is a slight skin color break on the first fruit of a crop. Early fruit from a single flowering should only be harvested after a slight skin color change; 2 weeks later all full-sized fruit can be harvested, even if there is no apparent change in skin color. Other indices include SSC and TA, specific gravity, and days from blooming. These indices depend on cultivar and season (Hatton et al. 1965, Kanes et al. 1982).

Grades, Sizes, and Packaging

There are no U.S. or international grade standards. Fruit are sold in 16-kg (35-lb) cartons as well as 6-kg (14-lb) flat single-layer cartons and 4.5-kg (10-lb) single-piece fiberboard boxes with various counts.

Precooling Conditions

Fruit are normally forced-air cooled or room-cooled, preferably within 24 h of harvest (Mattern et al. 1972).

Optimum Storage Conditions

Storage at 10 to 13 °C (50 to 55 °F) with 85 to 90% RH should give a shelf-life of 14 to 28 days for mature green fruit, depending on variety. Ripe fruit can be stored at 7 to 8 °C (45 to 46 °F). Diseases are the principal factor limiting storage life. Optimum ripening temperature is 20 to 23 °C (68 to 73 °F) for best appearance, palatability, and decay control (Jobin-Decor 1988).

Controlled Atmosphere (CA) Considerations

Different cultivars show various responses to CA. The optimum storage atmosphere for prolonging storage and shipping is 3 to 5% O_2 and 5 to 10% CO_2 at 7 to 9 °C (45 to 48 °F) with 90% RH (Yahia 1998). Ripening delays are minor and may not be economic in all situations. Polyethylene or other film bags, with and without an ethylene-absorber, give some delay in ripening. However, some film bags can also result in off flavor and abnormal skin coloration.

Retail Outlet Display Considerations

Mangoes can be displayed at store temperature and should not be misted. Bruised and diseased fruit should be removed from display.

Chilling Sensitivity

Chilling susceptibility varies with cultivar; 'Haden' and 'Keitt' are particularly susceptible. Most cultivars show injury below 10 °C (50 °F), especially if fruit have just reached maturity. Tolerance to chilling increases during ripening (Medlicott et al. 1990). The symptoms include grayish, scaldlike discoloration on the skin, followed by pitting, uneven ripening, and poor flavor and color development (Hatton et al. 1965, Medlicott et al. 1990). Heat treatment prior to storage reduces injury in 'Keitt' (McCollum et al. 1993).

Ethylene Production and Sensitivity

Mangoes have moderate ethylene production: 1 to 2 µL kg^{-1} h^{-1} at 20 °C (68 °F). Ethylene induces faster and more uniform softening (Lakshminarayana 1973, Barmore 1974). Ethylene treatment can be done prior to shipping (Barmore and Mitchell 1977). There is disagreement in the literature regarding effect of ethylene treatment on quality (Chaplin 1988). This may relate to maturity when treated. Treatment of immature fruit leads to softening, but the fruit have poor flavor.

Respiration Rates

Temperature	mg CO_2 kg^{-1} h^{-1}
4.5 °C	10 to 22
10 °C	23 to 46
15 °C	45 to 90
20 °C	75 to 151

Data from Karmarkar and Joshi (1941) and Lam (1987).

To get mL CO_2 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 ton^{-1} day^{-1} or by 61 to get kcal $tonne^{-1}$ day^{-1}.

Heating for insect disinfestation elevates respiration 3- to 5-fold; after cooling, rates remain

higher than those of unheated fruit for 4 to 6 days (Mitcham and McDonald 1993).

Physiological Disorders

Some disorders, such as chilling injury and high CO_2 injury, are induced after harvest, while others are inherent. Inherent disorders occur intermittently and are unpredictable; for example, jelly seed, which results in watery, translucent tissue around the seed giving an over-ripe appearance. It does not develop after harvest unless it was present at harvest (Young and Miner 1961). Some cultivars are very susceptible, such as 'Tommy Atkins' (Lelyveld and Smith 1979). Soft nose and internal breakdown (or spongy tissue) are other disorders (Lim and Khoo 1985), though it is possible these are the same condition. Sap burn is a major problem with some cultivars (O'Hare 1994), such as 'Kensington,' while 'Irvin' is less susceptible (Loney et al. 1992); washing with water and detergent helps avoid damage (Brown et al. 1986).

Postharvest Pathology

Anthracnose *(Colletotrichum gloesporioides),* which is caused by preharvest infection and does not spread postharvest, and the postharvest stem-end rots caused by several fungi that infect before and after harvest (often as wound invaders that spread postharvest) are the two most common diseases (Johnson and Coates 1993). Anthracnose appears as fruit ripen and first appears as superficial black spots and streaks that then become sunken (Fitzell and Peak 1984).

Alternaria rot *(Alternaria alternata),* a preharvest infection, can sometimes be a problem, while the postharvest wound infections can occasionally be severe, such as black mold (*Aspergillus* spp.) and transit rot (*Rhizopus* spp.). Disease control begins in the field followed by postharvest sanitation, as well as avoidance of latex burn (stain) and mechanical injury. Hot-water treatment (46 ºC for 60 to 120 min) and fungicides can be used, depending on the cultivar (Spalding and Reeder 1986). Hot-water brushing at 55 ºC (131 ºF) for 20 s shows good control (Prusky et al. 1999).

Quarantine Issues

As a fruit fly host, mango must be treated prior to import into the United States. Hot water at 47 °C (116 °F) for 65 to 90 min, vapor heat with fruit core temperature of 46 to 48 °C (115 to 118 °F), and irradiation (300 grays) are potential treatments.

Suitability as Fresh-Cut Product

Fresh-cut pieces and slices are frequently found in markets. Browning of the flesh can be a problem.

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