Rules of thumb for domestic mango supply chains

Key points

- Holding mango fruit at 12–13˚C through the supply chain will help achieve a supply chain life of up to 27 days.
- Changing the average holding temperature to 20˚C will cut the supply chain life to a maximum of 22 days. Warmer temperatures than this will further reduce the supply chain life.
- To maximise the marketing options for the retailer and potentially the returns to the grower, ensure mangoes are at the correct temperature when they go into the truck bound for market.

Definitions

Supply chain life: The period in days from harvest until the product becomes unfit for use, consumption or sale. This commonly includes storage life, supermarket shelf life and pantry/fruit bowl/ refrigerator shelf life.

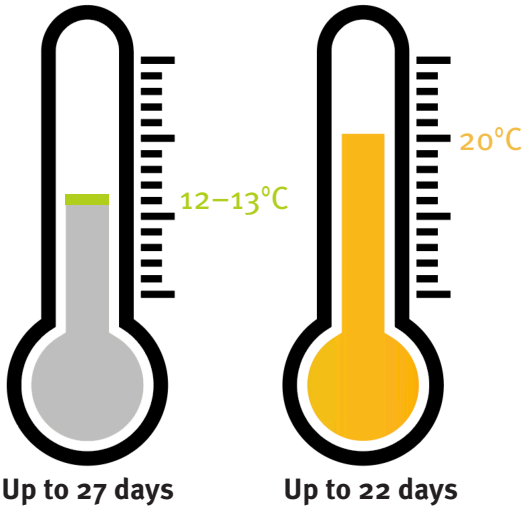
The features of R2E2 mango that define when fruit is unfit for use, consumption or sale, include the presence of any rot, firmness ‹40 on Shore AA scale, spongy stem, and or skin marking of ›4 cm² (chilling, VHT damage or other).

Supply chain: The period between harvest and consumption to accommodate steps including logistics, transport, storage, ripening and marketing.

Biological limits: The temperature at which normal fruit processes, such as ripening, cease or are significantly interrupted. This may involve the display of deterioration symptoms on the fruit skin or in the flesh.

This includes when fruit are physiologically damaged, and ripening is stalled, the skin is marked, rots are initiated and or the flesh starts to degrade.

Effect of temperature on supply chain life



Supply chain stages

Harvest to packing

- Pre-cool fruit to 12–13˚C within 36 hours of harvest (Mango Ripening Manual, 2012).

Pre-ripening storage

- Hard green fruit that are 3 days or less from packing and have not been ripened or VHT treated can be stored at 10–14˚C for up to 7 days [Kensington Pride (KP) and Honey Gold], or up to 10 days [R2E2 and Calypso], in non-controlled atmosphere conditions before ripening (Mango Ripening Manual, 2012).

Post-ripening storage

- The time fruit can be stored at 10–12˚C post-ripening will depend on the stage of fruit firmness and the variety (Mango Ripening Manual, 2012).

Variety	Sprung (50–64 Shore AA)	Firm ripe (38–50 Shore AA)
KP & Honey Gold	3 days	1 day
R2E2 & Calypso	5 days	3 days

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Temperature spikes and changes through the chain

- Short modest spikes in temperature at loading and unloading do not have much impact on fruit quality or the supply chain life.
- While the amount (temperature x duration) of departure from best practice affects fruit quality and supply chain life, the pattern of departure from best practice is less important if conditions stay within biological limits.
- For example, in VHT-treated R2E2, virtually the same result is achieved when fruit is stored for 6 days at 16˚C as when it is stored for 3 days at 13˚C then 3 days at 19˚C (Serviced Supply Chains project, 2020).

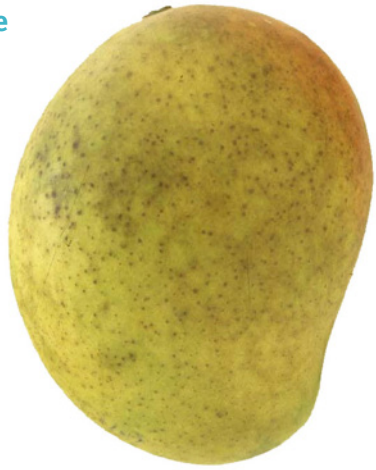
Outside the biological limits

- The risk of chilling injury increases as the fruit is exposed to temperatures below 13˚C. The risk escalates if fruit temperatures drop below 10˚C (see image of fruit with greying skin due to chilling damage). The longer the exposure the greater the risk of damage.
- Aside from the temperature and duration of exposure, chilling sensitivity can be influenced by time from harvest, fruit maturity, growing conditions, various fruit conditioning treatments, fruit coatings and or the use of controlled atmosphere storage.
- Storing fruit above 24˚C can result in a delay in ripening, skin yellowing can be blotchy and or retarded, and ripe fruit are more prone to rot development.

What we know about temperature management in domestic transport

- Most trucks are cooled from the top of the load, frequently using delivery chutes to distribute the cool air more evenly along their length.
- Most trains have systems that feed the air through the slotted floor of the carriages.
- In both trucks or trains, position temperature loggers at least three rows from the top or the bottom of the pallet to get representative temperatures of the majority of the consignment.
- Most trucks are not air-tight and attempts to ripen fruit in trucks are usually unsuccessful due to poor temperature and ethylene management.

Fruit with greying skin due to chilling damage



More information and references

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