



Rules of thumb for export mango supply chains

Key points

- Monitor mango temperature throughout the supply chain and ask chain partners to correct any departures from best practice. Mangoes must be 12–13°C when they leave the pack shed, freight forwarder and at the importer.
- Mangoes at 13°C can handle a maximum of 9 days in a refrigerated sea container but up to 20 days when Controlled Atmosphere (CA) is used.

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.

Air freight temperature management

- Often the best way to maintain stable temperatures through an airfreight supply chain is to monitor consignment temperatures, ensuring the temperatures are ideal (12–13°C) when they leave the pack shed, freight forwarder and at the importer. If not, ask those persons responsible to cool the fruit to ideal temperatures before they are dispatched.
- Many airfreight loading and unloading areas at airports are not refrigerated and this requires efficient logistics management by your freight forwarder to reduce the risk of poor cool chain management in this phase. Fruit temperatures of >30°C have

Sea freight transit times for mangoes held at 13°C



been recorded on the airport tarmac while fruit are awaiting loading onto the airplane.

- There is as much risk of increasing fruit temperatures in poorly managed hot locations, as there is of chilling damage in cold locations.
- Jet cargo holds are not refrigerated, so typically if a consignment of ripening fruit leaves the freight forwarder at:
 - » 12°C, it may arrive at the importer at around 16°C
 - » 16°C, it may arrive at the importer at around 20°C
 - » 20°C, it may arrive at the importer at 28°C or above.

Impact of Vapour Heat Treatment (VHT)

- If exporting mangoes to China or South Korea, Vapour Heat Treatment (VHT) is required as a disinfestation protocol. The current known VHT facilities are in Brisbane (Perfection Fresh and Hannay Douglas), Giru (Manbulloo), Mareeba (Diamond Star) and Darwin (NT Airports).
- Increasing the time between harvest and VHT treatment increases the risk of heat damage symptoms appearing when fruit near the end of their

supply chain life. Symptoms commonly include scald and lenticel damage (Serviced Supply Chains project, 2020).

- VHT treatment promotes the ripening process and potentially leads to at least a 2 day reduction in supply chain life.
- Airfreight export simulation trials involving VHT treated R2E2 fruit found:
 - » Fruit held at an average of 20°C during storage had a supply chain life of 22 days
 - » Cooling the fruit to 12°C for at least 12 days extended supply chain life to 27 days.

Sea-freight

- While sea-freight containers are usually good at holding temperatures during transit, fruit must be cooled to the ideal storage temperatures (12–13°C) before it is loaded into the sea container.
- Sea-freight to close destinations (e.g. New Zealand) offers stable temperatures over short periods (maximum of 9 days in refrigerated sea container).
- Sea-freight to distant destinations (e.g. Asia), offers stable temperature management over longer periods (maximum of 20 days in refrigerated sea container), but requires controlled atmosphere (CA) storage.
- CA suppresses respiration rate and ethylene production. It has the potential to reduce the incidence of chilling injury, providing the length of storage is not excessive nor the temperature too low.
- CA equipment must be setup by a trained professional. Levels of O₂ lower than 2% and elevated CO₂ (>6%) will promote anaerobic respiration leading to the development of off fruit flavours and other quality issues (Lalel and Singh, 2006).
- Sea-freight export simulation trials found hard green R2E2 and KP can be stored for up to 38 days and 35 days, respectively, at 13°C under controlled atmosphere (3% O₂ and 6% CO₂) conditions, plus an undisclosed number of days to ripen fruit at 21°C (Lalel and Singh, 2006).
- Sea-freight export simulation trials found VHT treated R2E2 can be stored for up to 20 days at 13°C with CA (2% O₂ and 5% CO₂), plus the 4 days load consolidation at the pack-shed, plus 10 days in other parts of the supply chain. (Serviced Supply Chains project, 2020).

- Sea-freight export simulation trials found VHT treated R2E2 had shorter supply chain life if late season fruit was exported. This may in part be associated with higher dry matter maturity in late harvest fruit.
- Typical days from Brisbane port loading to destination port unloading are:

Destination ex Brisbane	Days
Singapore	16
Busan (South Korea)	25
Hong Kong / Guangzhou (China)	18–26
Jebel Ali (UAE)	24–35

(Serviced Supply Chains and Innovations Connection projects' data, 2020)

More information and references

Noel Ainsworth

Principal Supply Chain Horticulturist
 Department of Agriculture and Fisheries
 T: 07 3708 8563 M: 0409 003 909
 E: noel.ainsworth@daf.qld.gov.au

John Agnew

Senior Horticulturist
 Department of Agriculture and Fisheries
 M: 0436 849 357
 E: john.agnew@daf.qld.gov.au

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