Cold Chain Logistics
Resource Centre

Confederation of Indian Industry

Mango

Care During Handling

Mango is to be packed in the field after proper drying; otherwise, it will start ripening. Crate is the preferred packing, although paper box packing is also followed. Gradual temperature treatment is recommended. Ripening temperature depends on the variety. Ex: Banganapalli may need a high temperature above 22°C being thick-skinned.

No Sharp temperature treatment during pre-cooling; else, it will harm the produce.

Proper de-sapping before fruit pack.

Mangoes show a climacteric pattern of respiration, and, during ripening, the flesh becomes soft and juicy with a rich flavour and aromatic fragrance.

The onset of ripening is accompanied by a five-fold increase in heat production.

In view of this substantial increase in heat production which accompanies the onset of ripening (before any visual change is apparent), it is essential that fruit for overseas shipment be cooled as soon as possible, preferably within 24 hours of harvest.

Freshness Facts

RECOMMENDED OPTIMUM CARRYING TEMPERATURE
8°C-10°C (For thin skin varieties)

HIGHEST FREEZING POINT
-1°C

ACCEPTABLE PRODUCT TEMP. AT LOADING INTO CONTAINERS
Max. 2°C above carrying temperature

OPTIMUM HUMIDITY
85%-90%

Ventilation setting for containers	**25 m^3/hr**
Storage life	**3-4 weeks**
Climacteric / non-climacteric	**Climacteric**
Ethylene production during Ripening	**Moderate (100 ppm or 0.1%)**
Ripening Temperature	**20-22°C**
Ethylene sensitivity	**High**
Modified / controlled atmosphere	**5%-8% CO_2; 3%-7% O_2**
Potential benefits	Low O_2 can delay ripening Elevated CO_2 maintains firmness

If more than a small proportion of mangoes has entered the climacteric stage by the time of loading into refrigerated space, there is a risk that heat production by the mangoes may impose too great a burden on the cooling cycles. If this happens, more and more fruit is triggered into ripening in an atmosphere depleted of oxygen and rich in carbon dioxide and ethylene.

The temperature rises further and ripening proceeds in abnormal fashion. Inadequate ventilation may result in fermentation and rotting of the cargo because of increased CO_2 levels and inadequate supply of atmospheric oxygen.

Storage at 8°C to 10°C with 85% to 90% RH, should give a shelf-life of 3-4 weeks for mature green fruit, depending upon variety.

O_2 below 2% for longer than two weeks can cause off-flavors and skin discoloration. CO_2 above 10% can cause softening, off-flavors, and greyish flesh color.

Symptoms of chilling injury include uneven ripening, poor colour and flavour, surface pitting, greyish scald-like skin discoloration, increased susceptibility to decay, and, in severe cases, flesh browning.

Chilling injury incidence and severity depend on cultivar, ripeness stage (riper mangoes are less susceptible) and temperature and duration of exposure.

Surface Transport

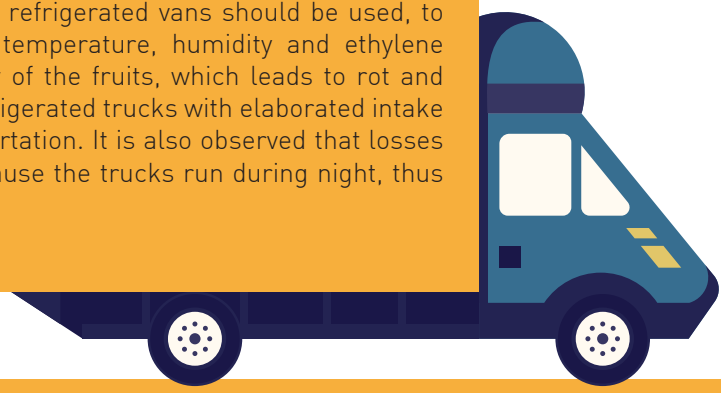
Surface transport is preferred more than other modes of transportation due to its easy approach from orchards to the market. In surface transportation, head load, animal pack, bullock carts, auto rickshaw, lorry, minitrucks and trucks are the primary means of transportation, and their use depends upon geographical location of the orchards, distance from the markets, etc.

For shorter distances, the Mangoes are transported as head load while for a radius of 10-20 Km., bullock cart/tractor trolley, auto rickshaw, mini lorry is quite common. The produce is covered in Tarpaulin. Stack height is usually kept between 4-8 and transportation is mostly done during the night.

For carrying the fruits to more than 100 Km., use of trucks is found to be the most convenient mode of transport due to its easy approach from orchards to the markets.

Trucks sometimes exert pressure on the fruits and do not possess temperature reducing devices. Therefore, it is important to design and develop suitable transport system.

For long distance transportation and export purposes, refrigerated vans should be used, to reduce the post-harvest losses. It is observed that temperature, humidity and ethylene production during the transportation affect the quality of the fruits, which leads to rot and dehydration of the fruit. Therefore, insulated and/or refrigerated trucks with elaborated intake capacity should be used for long distance road transportation. It is also observed that losses during transit by trucks are considerably reduced because the trucks run during night, thus avoiding excessive heat impact of the day.



Rail Transport

Rail transport has certain advantages over surface transport. In rail transport, the damage to the produce is less as compared to that of rough roads. The transport cost is also much less in using Rail as the mode of transport. Transport by rail is preferred when the commodities are to be transported in bulk or when the distances involved are long. When fruits are transported by rail, particularly over longer distances, losses are more mainly because of frequent delays in the movement of the wagons. However, air-conditioned containers on the Indian Railways have done a commendable job in reducing spoilage and extending the keeping quality.

Coaches maintain a temperature of 12.8-15.6°C, with a relative humidity of 60%

Air Transport

Air transportation is the fastest but most expensive mode of transport. However it, is important for high-value short-life commodities.

Generally, refrigeration facilities are not available and on the contrary, low-pressure environment with low RH are encountered at high altitude. This increases the rate of water loss of the produce.

For air transportation, providing PE Film liner with perforation within box or over-wrapping of unit load is necessary. Packed produce coming in for air transportation must be pre-cooled sufficiently to counterpoise the lack of refrigeration facility.

It is necessary to transport the precooled produce in insulated or refrigerated trucks /vans to airport to obviate possible delays in loading due to late arrivals or non-availability of required space on a particular flight.

Water Transport

In-land, waterways can be used as an effective means of transport for fresh fruits and vegetables. Although marine transport is relatively slow which consumes more time in comparison to other means of transportation to cover long destinations, inter-continental transportation, ship is the cheapest and most energy efficient. To survive long distance transportation in waterways, most of produce requires low temperature environment with enough ventilation to minimize CO_2 and ethylene accumulation. Refrigerated modular containers should be used in cases, where loading is done at the packing house/centre and transported on trucks to the port, for onward transportation. Transport of Mangoes by boats is a common practice in West Bengal and Assam. This method of transport is the cheapest.