Punjab Horticultural Postharvest Technology Centre
Punjab Agricultural University, Ludhiana

# PHPTC Newsletter

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## Postharvest Handling Practices and Cold Chain Management for Export Marketing of Kinnow Fruit

In Punjab, growing of fruit, vegetable and flower has received considerable impetus under National Horticulture Mission programme. The horticultural crops particularly fruits occupy an area of 78 thousands hectare with production of 16 lakh MT. Among fruit crops, the citrus fruits mainly 'Kinnow' enjoys prominent position in Punjab and grown on an area of about fifty thousand hectare with production of about ten lakh metric ton. The demand of this fruit is also increasing in the foreign markets. Thus there is immense opportunity in expanding area under this crop. Recently, Punjab Agricultural University, Ludhiana has released other outstanding cultivars of mandarins such as Daisy, W.Murcott and PAU Kinnow-1 for commercial cultivation in Punjab state.

Kinnow is ready for harvest in the month of January and continued till March. However, its marketing is badly hampered in Punjab and adjoining states due to extreme cold and foggy weather conditions. Hence, its promotion in southern and western states such as Karnataka, West Bengal, Maharashtra, Andhra Pradesh, Gujarat etc can be successfully explored, where pleasant weather prevails during these months. The fruits are usually packed in CFB boxes and transported to distant markets under non refrigerated conditions resulting in losses in terms of weight, firmness and other quality attributes. Distribution of Kinnow in India is mainly performed on trucks. A traditional supply chain goes from the farmer to the whole seller in the mandi then on to the retailer. This practice results not only in quantitative losses but also qualitative and monetary losses. The adoption of cold chain practices can help in exporting Kinnow in distant markets without loss of quality.

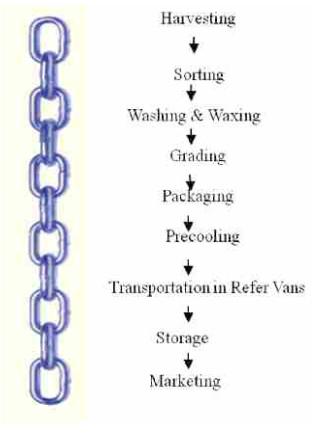
**1. Nutritive and medicinal value of Kinnow:** Research studies conducted at Punjab Horticultural Postharvest Technology Center in collaboration with Citrus Estate revealed that Kinnow is highly nutritious fruit with some therapeutic properties. It is a good source of vitamin-C, bioactive compounds like limonin, phenols and possesses high antioxidant activity. It has following composition:

| | |
|---|---|
| Juice | : 48-52% |
| Total Soluble Solids | : 10-12% |
| Acidity (citric acid) | : 0.5-0.7% |
| Vitamin-C | : 15-20 mg% |
| Limonin in juice | : 15-20 ppm |
| Limonin in seed | : 2000-2500 ppm |
| Limonin in peel | : 70-80 ppm |
| Pectin in peel and pomace | : 2.0-2.5% |
| Vitamin A in juice and peel | : 1.0-1.5 mg% and 5-6 mg% |

**2. Post-harvest infrastructure for Kinnow in Punjab:** Punjab Government has established good postharvest infrastructure especially for Kinnow:

- One pack house fully equipped with cold rooms, pre-cooling unit and waxing-cum grading line has been established at village Badal, Distt. Muktsar Sahib.
- One pack house fully equipped with cold room, pre-cooling unit and waxing-cum grading line has been established at KangMai, Distt. Hoshiarpur.
- Five citrus estates, Hoshiarpur (Chhauni Kalan and Bhunga), Fazilka (Abohar and Tahliwala Jattan) and Muktsar Sahib (Badal). All estates are equipped with commercial washing, waxing and grading units.
- Two processing units for processing of Kinnow juice at Hoshiarpur and Abohar.
- Some progressive farmers have established their own waxing and grading lines and cold chain solutions such as cold stores, precooling units and refrigerated vehicles at Abohar and adjoining area.

**3. Important guidelines for harvesting and postharvest handling practices for export marketing:**



**i) Harvesting:** The best period for harvesting of Kinnow fruit is from mid January to mid February. The fruits should be cut with clippers, close to the peel of the fruits retaining shortest stalk and green button. The later is taken as sign of freshness as naturally dropped fruits don't retain the green button. All necessary precautions should be taken to prevent injuries, any contamination or cross contamination of the product after picking. The fruits should be washed with potable water to remove adhering dirt, dust, agro-chemical residues. It is recommended to disinfect the fruit with chlorine wash (100-150 ppm). After disinfection again rinse the fruit with clean water.

**ii) Waxing:** World over, citrus fruits are waxed with edible coating. During mechanical sorting and washing, brushes removes natural waxes from the peel surface, leading to faster rate of water loss and shriveling and these natural waxes are replaced with coatings, primarily of plant origin. The coatings, primarily based on Shellac, Carnauba and Bees wax have been approved by Food Safety and Standard Authority of India (FSSAI). Only those waxes are used, which are safe and approved by CODEX and regulatory authorities. The wax coating helps in checking the water loss from fruit surface, thereby preventing the aging of fruits during transportation and marketing. It also imparts fresh glossy appearance, which enhances the market value. The waxing of fruits can be done either mechanically (spray brush or spray nozzle type application) or manually (with foam pad, mist spray or dip method). After waxing, the fruits are again dried at temperature of 30-35°C. Washing and waxing operations should preferably be done before fruits are sent to market.

**iii) Grading:** For getting premium price and assuring quality to consumers, the fruits are graded for different sizes. The various grades recommended for Kinnow fruits by APEDA are as under:-

| | Size range (mm dia) | No. of fruits in 10 Kg pack |
|---|---|---|
| a. | 60-64 | 84 |
| b. | 65-69 | 72 |
| c. | 70-72 | 60 |
| d. | 72-74 | 54 |
| e. | 75-79 | 51 |
| f. | 80-85 | 45 |

**iv) Packaging:** The fruits should be packed in corrugated fibre board boxes, having 10 kg capacity. Usually 2 pieces, telescopic, CFB boxes of 5 ply with waterproof coating to tolerate high humidity during shipment are preferred. Normally a box of size 45 cm x 24 cm x 18 cm having 10 kg capacity is very common and acceptable for export marketing. The box must have 5% area punched as holes for ventilation. A divider having ventilation holes is inserted in between layers, which will act as cushioning material. It has been seen that 10 Kg boxes containing 45-60 Kinnow fetch maximum price in markets. In the retail marketing the fruit can be sold in paper moulded trays wrapped with shrink packaging film. These can be packed in 4, 6 and 12 pieces.

**v) Labelling:** The label on the box should be very attractive and appealing and should carry name of the produce, variety, country of production, weight of box / number of fruits in the box, date of packing, name of packing organization.

**vi) Precooling:** After packaging the fruits should be kept in precooling units (Forced air precooling) at 6-8°C and 90-95% RH for 6-8 hours in order to achieve the desired temperature of fruits before transportation under refrigerated conditions.

**vii) Transportation:** The corrugated boxes should be gently and properly stacked and braced up to avoid vibration, bouncing and load shifting. Loading should be done in such a way that there is proper air movement. The fruits should be transported from pack house to destination markets at 5-7°C and 90-95% RH.

- Under no circumstances, fruit should be sent to the port in ordinary trucks.

- Transport promptly to the port without losing any time.

**viii) Storage:** The fruits should be stored in cold store at 5-7°C and 90-95% RH. It must be ensured that temperature of the cold store should not fall below 5°C otherwise it can result into chilling injury. Un-bruised and mature Kinnow fruit can be stored up to 45 days at 5-7°C and 90-95% RH with acceptable quality.

**ix) Marketing:** Kinnow is a perishable fruit and therefore needs careful handling and strategy during marketing. Waxing and packaging are two very important components which not only add value to the fruit but also make it shelf stable. During peak harvesting period, a glut like situation is witnessed in the market resulting in price crash and huge postharvest losses. The farmers and entrepreneurs are advised to make their own association and follow the standard postharvest handling practices for marketing their quality produce. It will help in minimizing their exploitation in the hands of traders. The regular training programmes are organized by Punjab Agricultural University on postharvest handling, value addition and marketing of fruit and


vegetable. Punjab Horticultural Postharvest Technology Centre (PHPTC), P.A.U. Ludhiana is a nodal organization to guide farmers and entrepreneurs for establishment of pack house and cold chain infrastructure for horticultural crops. The farmers should contact Punjab Agricultural University, Ludhiana for further information and guidance. Various schemes are available for creation of postharvest infrastructure such as integrated pack house, cold storage, waxing and grading lines etc under National Horticulture Mission (NHM) programme. The farmers and traders can contact or visit the offices of Punjab State Department of Horticulture at block or district level for assistance.

**4. Potential for export and distant marketing:** Kinnow has reasonably good storage life of 6-7 weeks in cold storage, therefore has good potential to export. During last two years good efforts were made by Surinder Charya, Pardeep Dawra and Shivam Setia progressive farmers from Abohar to export Kinnow fruits from Abohar to Russia, Ukraine, Middle East countries and Bangladesh etc under cold chain conditions. Similarly, they also took initiative to successfully transport Kinnow to Bangalore, Mumbai, Ahmedabad etc under cold chain conditions. They have established a state-of-the-art precooling unit and cold storage with the technical guidance of PHPTC, PAU, Ludhiana. The adoption of cold chain protocols can help in exporting Kinnow on a regular and predictable basis by preserving quality of the fruit across long distances. Many agencies like APEDA and Punjab Agro Industrial Corporation (PAIC) are promoting and facilitating distant and export marketing of Kinnow. Farmers and entrepreneurs can contact these organizations for further assistance

## PHPTC Activities

**Training Programme for farmers :** The centre conducted 11 training programmes for farmers on postharvest management and marketing of horticultural crops in collaboration with Directorate of Horticulture, Punjab. These trainings were funded by National Horticulture Mission programmes.

## New Recommendations

PAU Research Evaluation Committee approved the following recommendation :

**Design of Corrugated Fiber-board Boxes of 2Kg, 4Kg & 10 Kg Capacity for Packaging of Litchi Fruit:** Corrugated fiber board boxes of size 340 mm x 220 mm x 100 mm and 340 mm x 220 mm x 185 mm (3-5 ply) can hold about 2 Kg and 4 Kg of litchi fruit for local and distant markets respectively. The corrugated fiber board box of internal size 420 mm x 235 mm x 210 mm (5 ply) can carry on an average 8-10 kg litchi fruit for distant and domestic wholesale marketing.


**2 Kg Box (340mm x 220mm x 100mm)** | **4 Kg Box (340mm x 220mm x 185mm)**

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