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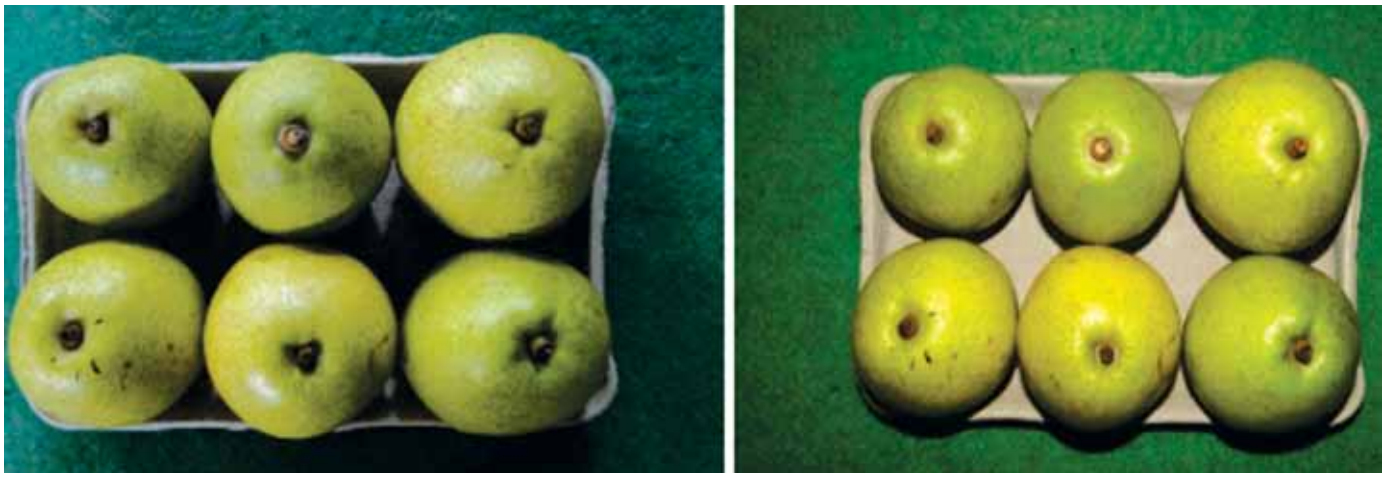
Harvesting and handling of low chill temperate fruits

With the advent and introduction of low chill fruit varieties, the cultivation of temperate fruit crops such as peach, pear and plum get the impetus across the sub tropical regions of northern India. The cultivation of low chill peaches (Partap, Florda Prince, Shan-i-Punjab, Earli Grande, Prabhat, Punjab Nectarine), pear (Punjab Nakh, Punjab Gold, Punjab Nectar, Punjab Beauty, Punjab Soft, Nijisseikki) and plum (Sutlej Purple, Kala Amritsari) has attained significant position for the last few decades due to higher productivity, efficiency, regularity in bearing and more remunerative returns. The regions comprising Punjab, Haryana, Uttar Pradesh including Terai regions lies in the south of the outer foothills of the Himalayas, *Shivalik* Hills, and north of Indo-Gangetic Plains are suitable for the cultivation of low chill temperate fruits. Furthermore, there are known for the quality production due to the availability of unique climatic conditions, availability of 150 to 350 chilling hours as well as mild temperature suitable for flowering and fruit set. The majority of temperate fruits are climacteric in nature. As a result, the physiological factors like respiration, transpiration, ethylene production, physiological disorders and pathological breakdown are associated with their shelf life. The shelf life of temperate fruits is gradually decreased with the upsurge in ethylene production after fruits harvest.

A thorough understanding of the harvest and post-harvest handling interventions is the essential to extend shelf life as well as to maintain the fruit quality parameters during storage. A brief description, about the post-harvest handling techniques for temperate fruits grown in sub-tropics is discussed in this article.

Maturity indices for harvesting

Maturity indices play an important role to determine the harvesting time, schedule of harvesting, packing operations and also ensure the fruit quality. Maturity time of fruit crops differs significantly and depends upon the purpose and distance of market from the site of production. Fruits harvested too early may not ripen, as all the fruits cannot ripe after harvesting and only climacteric fruits can ripe after harvesting. In contrast, fruit harvested too late leads to over-ripening and may damage on tree or during harvesting and handling. A series of maturity indices have been suggested to decide the harvesting period of low chill temperate fruit crops.



Packaging in moulded trays

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Maturity indices for different temperate fruits

Maturity index	Fruit crop
Days from full bloom to harvest, Calendar dates	Pear: *Pathar Nakh* 145 days; Baggugosha, Punjab Beauty 135 days; Punjab Nectar, Punjab Gold 140 days; Punjab Soft and Nijjiseiki 125-130 days from full bloom. Punjab Nakh 4th week of July Peach: Partap, Florda Prince, Shan-i-Punjab and Earli Grande mature in 3rd week of April, 4th week of April, 1st week of May and 1st week of May (4 days earlier than Shan-i-Punjab), respectively. White flesh peach varieties: Prabhat, Khurmani and Sharbati mature during 3rd week of April, 1st week of June and 1st week of July, respectively and Punjab Nectarine in 2nd week of May Plum: Satluj Purple, Kala Amritsari (Ist fortnight of May)
Size and shape (Fullness of cheeks)	Pear, Peach, Nectarines, Plum
Ground colour	Pear (colour changes from dark green to light green and yellow), Peach and Nectarines (red blush on fruit peel), Plum (Purple colour)
Firmness	Pear, Peach (10-12 pound force firmness), Plum (5.7 kg firmness)
Starch content	Pear
TSS	Pear (12-13 %), Peach (10-13%), Plum (13-15 %)
Sugar content	Pear, Peach, Plum
Internal ethylene concentration	Pear

Harvesting and ripening

Picking is an important step in fruit harvest and post-harvest management. Generally, fruit harvesting is done in early morning hours. In pear and stone fruits, fully mature fruits are harvested at firm stage for canning and distant market. However, fruit for local consumption should be harvested at slightly advance stage of fruit maturity. Two or three pickings at an interval of 3-4 days are preferred than single picking. The choice of harvesting techniques is crucial for ensuring optimal fruit quality. Fruits from the upper tree canopy may be harvested with the ladders without damaging the scaffold branches and limbs. Farmers prefer to harvest fruit with hands for marketing of low chill temperate fruits. Fruits are harvested by giving an upward twist to the fruit to avoid spurs damage especially in pear. This separates the mature fruit from mother tree without a force. Plums are harvested along with pedicels to avoid any injury to the fruit. In order to avoid bruising and stalk damage, fruits are hand plucked individually by giving a gentle twist rather than direct pull. Precaution must be taken not to puncture the fruits with finger nail. Fruits should be collected in baskets/plastic cartons padded with cushioning materials at bottom and on the sides to prevent injury or fruit bruising. The harvested produce should be carefully handled and transported to pack houses to remove field heat as well as for grading and packing.

Fruits eating quality of 'Punjab Beauty' and '*Patharnakh*' pear is improved when stored at temperature of 0°C and further at 20°C for 3 days and 4 days, respectively. Likewise, '*Patharnakh*' and 'Punjab Beauty' has attained the proper quality attributes when these will be treated with 1000 ppm Ethephon (2.5 ml/litre of water) or exposed to 100 ppm ethylene gas for 24 hours and stored at 20°C within 8 days and 4 days, respectively.

Washing and Grading

After harvesting, sort out the fruits with mechanical injuries, insect pest or diseases attack to reduce losses by preventing secondary infection. Fruits can be sorted manually at farm level or in pack-houses. Healthy fruits should be thoroughly washed with 100 ppm chlorinated water, it prevents/ delays the bacteria, molds and yeasts infection. Calcium hypochlorite (powder) and sodium hypochlorite (liquid) can be used to prepare the chlorinated solution. Ideal pH for chlorinated water is 6-7 for disinfection.

Grading involves separation of fruits on basis of size, shape, weight, surface colour and firmness. It forms an integral part for better marketing. Well graded fruits fetch better price, since it creates better appeal to consumers. Grading can be done manually by skill labour and packers depending on ground colour.

AGMARK standards for marketing temperate fruits

Fruit crop	Grade	Fruit size dia (mm)
Plum	Special	42 and above
	Grade I	36-42
	Grade II	Below 36
Pear	Extra large	75
	Large	65
	Medium	55
	Small	50

Packaging

The primary role of packaging is preservation of quality and protection from external contamination. Earlier wooden crates, bamboo baskets were used for packaging. But, now-a-days corrugated fibre wood cartons, plastic films with entrapped air bubbles are used for long distance transportation. The packages should be strong, non-toxic, low in cost, unaffected by moisture and presentable in form. During packaging, the fruits should be arranged in layers in the containers. Both bottom and

top portions of the container should be cushioned with dried grass or paper for avoiding compaction and bruises to fruits. Label indicating the grade, cultivar and name of orchard should be pasted, printed or stamped on the container. Fruits should be transported to local and distant markets after packing in corrugated fibre boxes (CFB) and plastic crates. Further, all field containers should be frequently examined for any sharp edges, protruding nails or staples and sand or gravel that could cause injury to fruit.

Wooden, plastic or cardboard boxes, pulp moulded /expanded polystyrene trays etc. are generally used for packing of pears, peaches and plums. Corrugated fibre board boxes are light in weight, easy to handle and eco-friendly. The shrink packaging film is also an effective way for prolonging the shelf-life and maintaining the quality of peach fruits for 9 and 4 days under super market conditions (18-20°C; 90-95% RH) and ordinary market conditions (28-30°C; 60-65% RH), respectively as against 6 and 2 days only in case of unpacked control fruits under both the marketing conditions. Plums are packed in shallow crates about 4-5 inches deep, packing not more than 3 layers of fruit.

Storage

The temperature and humidity levels under storage play an important role in affecting the quality of fresh produce. There is an optimum storage temperature for all fruits.

The shelf life of fruits can be further extended with the use of better storage techniques such as controlled atmosphere (CA) storage. In this technique not only the fruits are cooled to reduce respiration, but the oxygen and carbon dioxide gas mixtures are also carefully regulated. By reducing the oxygen level and increasing the carbon dioxide content, a considerable reduction in respiration is attained which thereby, enhances the shelf life of produce. In CA storage, containing 5 % carbon dioxide and 1 % oxygen at 0°C, peaches can be stored upto 42 days.

SUMMARY

The valley and plain areas of north India occupy significant acreage under low chill temperate fruit crops. However, urbanisation has led to reduced per capita availability of agricultural lands. Under such circumstances, the possibility for area expansion under fruit crops is impractical. Instead, constant efforts

Packaging of pear and plum fruits using corrugated fibre board boxes

Packing standards for different grades plum fruits

Grade (Plum)	Box size inner (inches)	Number of layers	Number of fruits per layer
Special	14.5 × 6.5 × 6.5	3	28-32
Grade I	14.5 × 6.5 × 6.5	4	38-42
Grade II	14.5 × 6.5 × 6.5	4	50-56

Storage temperature conditions for different temperate fruits

Fruit crop	Storage temperature	Storage period
Pear cvs. Punjab Beauty, *Patharnakh*, Punjab Nakh pear	0-1°C, RH 90-95%	60 days with post-storage shelf life of 1-2 days at ambient temperature and 4 days in refrigerator
Pear cv. Punjab Soft	0-1°C, RH 90-95%	4 weeks
Pear cv. Punjab Soft	Post harvest treatment with $CaCl_2$ (2%) for 5 minutes at 0-1.0°C, RH 90-95%	60 days
Peach cv. Shan-i-Punjab	Post harvest treatment with calcium chloride (2%) for 5 minutes at 0-1.0°C, RH 90-95%	30 days
Plum cv. Satluj Purple	Post harvest treatment with calcium nitrate (2%) for 5 minutes at 0-1.0° C, RH 90-95%	28 days with post storage shelf life of 2 days at ambient temperature

are required to manage the post harvest losses. Persistent studies focusing on their post harvest management and handling are required. At the same time, general awareness about the proper harvest and handling techniques of these crops is desirable for farmers as well as retailers.

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