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Packaging of Fresh Fruits and Vegetables

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Different horticultural products need different types of packages depending on their physical, anatomical and physiology (mainly transpiration, respiration and ethylene production rate) nature and susceptibility to microbial decay. Temperature, relative humidity and ventilation also plays a very important role in determining the post-harvest life of the fresh produce. Thus, the packaging requirements for fresh produce can be summarised as:

- Protection against bruising and physical injury
- Protection against microbial contamination and deterioration
- Provide ventilation for respiration and exchange of gases
- Protect against moisture / weight loss
- Slow down respiration rate, delay ripening and increase storage life
- Control ethylene concentrations in the package

Packaging Materials

The packages for fresh fruits and vegetables can be classified as:

- Consumer / Retail packs
- Transport / Bulk packs

Consumer Packs

Consumer packages are small in size and designed to hold ½ dozen – 1 dozen fruits or ½ kg to 2 kg of vegetables. Many types of packages in terms of forms and materials are used as consumer packs. The selection criterion for the type of consumer pack depends on marketing characteristics of the product. The most commonly used packages are listed below:

Flexible Plastic Films: Different types of flexible plastic films like LDPE (Polyethylene), PVC (Poly Vinyl Chloride), PP (Polypropylene) and cellulose acetate films are used for packaging of horticultural produce. These films are mostly used as pouches with holes punched at regular intervals to allow respiration. They are available in a wide range of thicknesses and grades and can be engineered to control the environmental gases inside the pouch. LDPE is the most widely used material.

Trays with Overwrap: The trays used are usually made of moulded pulp tray or plastic material like EPS, PVC and PP. The produce is placed in individual cavities so that abrasion and bruising is avoided during transportation. The trays also provide cushioning effect to the produce. The overwrap film is a transparent see through food-grade, odourless plastic film with the property of clinging to the product packed when stretch wrapped. This film can be applied without the application of heat. It is usually made of LDPE, LLDPE or PVC. The films are semi-permeable and allow exchange of gases for respiration of the product.

Plastic Punnets: These are strong, versatile, clear, bright containers, which offer product visibility and are provided with holes for ventilation, which keeps the produce fresh. These containers are food-grade, odourless, light weight, stackable and recyclable and give good presentation. They are either made of PET, PVC or PP.

Plastic Net bags (Extruded & Woven): The plastic net bags have the feature to stretch and accommodate all sizes and shapes of produce. These bags are available in roll form or in pre-cut lengths with stretch width of 200 mm – 400 mm. By allowing air to circulate in and around the produce, these net bags prolong the freshness and shelf-life of the fresh produce.

Foam Sleeve: This is a plastic tubular film made of polyethylene foam available in different colours, diameters and lengths. It can be easily slipped over the individual fruits in a snug fit form. It provides a cushioning effect and protects the fresh produce against abrasion and scratches during transit. It is hygienic, non- toxic and odourless.

Light Weight Plastic Crates: These are lightweight crates, which need not be put into an outer pack for transportation. The perforations provide ventilation and keep the produce fresh. The crates are stackable and have high compression strength and therefore provide adequate protection to the fresh produce packed inside. These crates are hygienic, clean, reusable and can be recycled. They can be made of HDPE or PP.

Shrink Wrap: One of the newest trends in fresh produce packaging is the shrink wrapping of individual produce. The greatest advantage of individual shrink wrapping is its ability to control moisture loss. By reducing the transpiration rate and maintaining the fruit firmness the film forms a barrier which increases the resistance to water vapour. The transpiration rate can be reduced 5 to 20 times using selective permeable plastic films. The individual fruit is loosely sealed in a flexible film. The film is then shrunk tightly around the produce by passing these packs through a heat shrunk tunnel where they are exposed to hot blown air for a very short period (few seconds). The fresh produce is then cooled by rapid ventilation. The films most commonly used are LDPE or LLDPE.

Corrugated Boxes/Cartons: Many fruits like mangoes, apples, grapes, etc. are packed in small packs of 2-4 kgs, either in corrugated boxes made of paper board or polymers like polypropylene. These boxes/cartons are light-weight with good compression strength. They can be printed to have a good shelf appeal.

Transport Packs

Transport packages are designed for long distance transportation in capacities ranging from 4 – 5 kgs to 20 – 25 kgs. These packs must withstand impacts, compression and vibration during transport. The transport packages can be broadly categorized as rigid containers made of wood, corrugated fibre board or plastics and flexible containers such as sacks made of plastic. Along with these materials some traditional materials used are jute (jute sacks), wooden boxes and bamboo baskets. The variety of packaging materials used for transport packaging of horticultural produce are listed:

Bamboo Baskets: Bamboo baskets are widely used even today as transport packs in domestic market. They are available in various shapes, sizes and designs but they do not have rigidity and stackability during long distance transport. Today plastic baskets or Kilta's have also been developed and used for storage & transportation of fruits & vegetables.

Wooden Boxes: The conventional baskets have been replaced by wooden boxes as they give better protection to the fresh produce against transportation hazards. They have high puncture resistance, good tensile strength as well as compression strength; but they occupy more space and add on to the tare weight. Also, the nails cause injuries to the produce during long transportation. However, the use of wooden boxes is discouraged now-a-days as it directly promotes deforestation.

Corrugated Fibre Board/Plastic Boxes: Corrugated fibreboard boxes are widely used as transport/ shipping containers for fresh produce because of the following advantages:

- Low cost to strength and weight ratio
- Good cushioning properties
- Smooth and non-abrasive surface
- Good printability on the outer surface of the board
- Easy to set up and collapsible for storage
- Reusability and recyclable
- Can be manufactured in high volumes

- Can be provided with ventilation by punching holes

Plastic Crates: These are usually made of HDPE or PP by injection moulding. Polyethylene has higher impact strength and a low degradation by ultra-violet radiation while polypropylene has a better scratch resistance. The performance of both materials can be improved by adding anti- oxidants and UV protectants (for sunlight protection).

Sacks: These are generally used to bring the raw materials from the field. The commonly used materials are cotton, jute, plastic (HDPE, PP). They are very useful because of low cost, high strength, re-useability and require less space for empties. However, they have low protection against puncture, compression, vibration and impact injuries. They are poor in stackability. These sacks are usually combined with bamboo baskets and wooden boxes to improve cushioning and reduce bruise injuries and losses during transportation.