

## Techniques for Packaging in Horticulture

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The global packaging market is projected to grow to \$1.05 trillion by 2024, with India accounting for 4% of the industry. Fruits, which are a great source of vitamins, minerals, and dietary fibers, tend to spoil quickly and are only available during certain seasons. In India, post-harvest losses in fruits and vegetables account for 20-25% of total production. To reduce these losses and increase shelf life, various packaging methods such as MAP, Active packaging, and Nano packaging can be used. Fiberboard cartons are the most commonly used material for fruit packaging, along with additional interior packaging such as trays, cups, pads, or tissue paper wraps. These practices help to prevent the spread of disease and germs, as well as provide physical protection.

### Packaging and Its History

Packaging is an art and science that protects products for distribution, storage, sale, and use. Its primary goal is to ensure product quality and extend shelf life. Early containers included gourd shells, leaves, logs, and animal organs. Paper packaging was the oldest, with commercial paper bags manufactured in England in 1844. Plastic became the preferred material in the late 20th century.

### Types of Packaging Methods

#### Corrugated fiberboard boxes

Corrugated fiberboard is a kraft-processed material made from unbleached pulp with a brown color. It comes in various styles and weights, with different grades and grades containing synthetic fibers, virgin wood fibers, and recycled fibers. Available in three, five, and seven-ply types, it provides strength and cushioning, with five plies offering additional stability and cushioning.



#### Double-faced corrugated fiber board

Double-faced corrugated fiberboard is a widely used packaging material, with manufacturers indicating strength limitations through licenses. Its maximum dimensions are determined by length, width, and height. High humidity and low temperature can weaken fiberboard containers, and moisture can degrade them up to 75%. Anti-moisture coatings are available to reduce moisture effects.

#### Styles of Corrugated Fibre board

Corrugated fiberboard containers come in two styles: Regular Slotted Container (RSC) and Full Telescoping Container (FTC). The RSC is simple and economical, suitable for low-stacking produce like potatoes. The FTC is used for greater strength and resistance to bulging. Bliss boxes are used for maximum strength. Glue seals the top and bottom, and containers can be printed using pre-print and post-print techniques.

### Pre-print

The quality of the package greatly influences the consumer's initial impression. According to Bala et al. (2018), if the expense is reasonable, this is one of the best printing methods for export. Pre-printing is generally of excellent quality, although it costs 15% more.

### Post print

Post printing is the procedure of printing the liner after the corrugated fiberboard is manufactured. This printing technique is popular for corrugated fiberboard containers since it's cost-effective and suitable for small press runs. Generally, post printing utilizes one or two colors, leading to less detailed images.

### Vent-hole design

Carton vents are crucial in the fresh fruit market, facilitating airflow and eliminating heat from respiration. They serve as access gates for cooling air, reducing carbon footprint. Precooling, the process of rapidly eliminating field heat after harvesting, is popular, with the tunnel horizontal airflow system being the most popular configuration.

### Conclusion

Fruit consumption is increasing globally due to population growth, requiring solutions for security,



freshness, shelf life, traceability, and supply chain. Intelligent, active, and nano-based packaging technologies offer solutions. Advancements in packaging could prevent spoilage and include RFID tags for tracking products. These advancements ensure fruit quality, safety, and stability, while meeting consumer demands. Smart materials must be affordable, safe, and eco-friendly.

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