



NEED AND IMPORTANCE OF POST HARVEST MANAGEMENT



Notes

You may have seen in newspaper the frequent incidences of price rises of common vegetables like potato, tomato or onion. Have you ever thought about why such significant price increases occur during particular periods of the year? One of the probable reasons for this is poor post harvest management of agricultural produce. Although, increasing agricultural production is considered the primary way to meet the growing demand for food, preventing losses after harvesting agricultural produce is another important option to achieve the goal of 'food for all'. India is major producer of paddy, maize, wheat, sorghum, pearl millet (bajra), fruits and vegetables in the world. However, a significant share of agricultural production in India is wasted due to post harvest losses. These losses are especially prominent in the case of perishable and bulky food commodities such as fruits and vegetables. These post harvest losses affect the availability of foods to consumers and increase their prices. Thus, post harvest loss remains an alarming issue in developing countries like India, where notable improvements have yet to be made.



LEARNING OUTCOMES

After studying this chapter, the learner:

- explains the importance of post harvest management;
- identifies the reasons for post harvest loss;
- classifies the different types of post harvest loss; and
- indicates the advanced technologies to manage post harvest loss.

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12.1 CAUSES AND EFFECTS OF POST HARVEST LOSS

Agricultural and horticultural crops are the main sources of income for farmers. They also provide livelihood for their sustenance. However, the value of crops may degrade after harvest if they are not handled properly. Horticultural crops (fruits, vegetables and flowers) are more perishable in nature than cereals or pulses and are prone to post harvest losses. Such food loss can be caused by variety of factors, including unfavourable weather conditions, improper crop production practices, inappropriate management during harvesting, handling, and processing, a lack of efficient transportation facilities, and poor storage infrastructure. Climate change is also amplifying these losses through erratic weather, which disrupts post harvest activities. The causes of post harvest losses can be divided into different categories:



Fig. 12.1 Causes of post harvest losses

A. Mechanical Losses

Horticultural crops are highly prone to mechanical injury due to their soft, tender texture and high moisture content. Poor handling, inappropriate containers, improper packaging, and transportation can easily cause injuries such as bruising, breaking, and cutting.

**B. Metabolic Losses**

The respiration process continues in all freshly harvested commodities, which result in the reduction of food reserves and cause ageing through the production of ethylene. Transpiration also continues in such commodities, leading to a loss of moisture content and a decline in quality of the produce.

C. Developmental/growth Stages

Germination of seeds before or after harvesting of crops, sprouting during storage of tubers or bulbs crops, and root development in stored commodities such as onion and carrot all cause a loss in nutritional content and quality.

D. Pathological and Insect-pest Deterioration

Microorganisms like fungi, bacteria, yeast, and other organisms attack crops after harvest, leading to high post-harvest losses. Most of the fresh commodities have an abundance of moisture and nutrients but they lack strong defense mechanisms, allowing microbes to spread rapidly in them.

E. Physiological Deterioration

Agricultural crops such as cereals, pulses, oilseeds, fruits and vegetables continue their physiological activity even after harvest. Mineral deficiencies, damage caused by extreme temperatures, and low or high humidity contribute to physiological deterioration. Enzymatic activity also leads to over-ripeness and senescence during this period.

F. Lack of Technical Support

Farmer needs technical support for quality planting materials, pest management, weather information, market insights, and storage facilities to scientifically manage their produce. The unavailability of such support often results in a significant compromise in the quality of agricultural produce.

G. Low market Demand

Over production of agricultural crops during certain parts of the harvest season saturates the consumer demand for the food products in market and create a situation leading to a market glut. In such situations, farmers are forced to sell their produce at low prices or risk it deteriorating on the farm or in the market areas.

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H. Poor Storage Facility

Excess crop produce could be stored for future use, however, sufficient storage facilities are often unavailable. Due to the perishable nature of these foods, any surplus is prone to rotting over time because of poor storage conditions.

I. Improper Utilization

The losses may also result from inadequate preservation, food preparation, and cooking techniques.

12.1.1 Effect of Post harvest Losses (PHL)

Post harvest losses of crop produce have lasting impacts on a country's economy and population.

- Improper harvesting techniques and rough handling of agricultural crops cause damage and injuries to fruit and vegetables, making them inedible.
- Damage to harvested products lowers their quality and market value, affecting both consumers' health and farmers' income.
- It reduces the opportunity for export to international markets.
- These losses create food shortages and disrupt supplies, especially for vulnerable communities.
- A significant amount of water, energy, and labour is required to produce crops; post harvest losses represent a waste of these resources.
- Decay and decomposition of wasted food or crop emit greenhouse gases which contribute to global warming.
- Post-harvest losses (PHL) represent a loss in both the quantity and nutritional quality of food, affecting acceptance in international markets and leading to economic losses for nations.

**INTEXT QUESTIONS 12.1**

1. PHL stands for



2. Horticultural crops (fruits & vegetables) are more prone to mechanical injury due to
 - a. Low water content
 - b. Hard texture
 - c. High nutrient content
 - d. Tender texture
3. Name any four reasons responsible for post harvest loss of food products.

12.2 WHY POST HARVEST MANAGEMENT?

The main aim of post harvest management is to ensure that agricultural crop comes with least amount of loss with maximum effectiveness from harvest to consumption resulting in better economic returns for growers, processors, and consumers. India produced 315.7 million tons of food grains during the year 2021-22, while horticultural production during the same period was 320.48 million tons. Still, 30-40% of the total crop is spoiled due to improper post harvest treatment. Reducing post-harvest losses is crucial for attaining global food security. When such losses are reduced and food quality is maintained, farmers, traders and handlers will be able to increase their income, thereby minimizing numerous social and economic problems. Therefore, effective management of post-harvest systems can greatly help in:

- **Loss prevention:** Both quantitative and qualitative losses of agricultural produce can be prevented.
- **Value addition:** Value addition to raw materials helps to gain more profit.
- **Digestibility:** Processing makes food materials more edible and digestible.
- **Maximization of nutritional value:** Proper storage retains nutrients for longer periods. It also improves synergy among minerals and reduces antagonistic effects of nutrients in food.
- **Organoleptic properties:** Effective management optimizes the appearance, colour taste, and texture of foods to meet consumer preferences.
- **Food safety:** Prior sanitation of food products can prevent food spoilage and reduce the chances of microbial contamination. For example, application of UV ray prevents bacterial contamination in eggs.

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Notes**INTEXT QUESTIONS 12.2**

1. Inadequate post harvest management results in both and types of loss.
2. Give two examples of organoleptic food properties.

12.3 TYPES OF POST-HARVEST LOSS (PHL)

Post-harvest losses begin during grading, packaging, storage, transportation, distribution, wholesale market, and retail marketplaces. Estimating these losses is essential for planning strategies to increase the availability of food for the population. Post harvest losses include weight loss, peeling, bruises, over-ripening, blanching losses, and spoilage, caused by microorganisms, insects, pests and rodents. Processing losses, on the other hand, include peeling, coring, trimming, pitting, blanching, and heat processing. Types of losses can be classified as:

1. Quantitative Loss:

The decrease in the weight of agricultural produce is termed as quantitative loss. The reason for this type of loss may be spilling, attack of insects, pests, and rodents.

2. Qualitative Loss:

It is caused due to mechanical damage or microbial contamination of the crops.

3. Nutritional Loss:

This refers to the reduction in the nutrient content of food as a result of quantitative or qualitative loss.

4. Germination Loss:

Germination loss refers to a decrease in the viability of seeds, which is particularly important for sprouts and microgreens.

5. Financial Loss:

It refers to the reduction in the economic value of product due to a reduction in either quantity or quality.



12.3.1 Important sites of Post-harvest Losses:

In India, significant post harvest losses are observed at the following stages:

- Farmer's field (15 - 20%)
- Packaging (15 - 20%)
- Transportation (30 - 40%) and
- Marketing (30 - 40%)

12.4 ADVANCED TECHNOLOGIES TO MINIMIZE LOSSES

Post-harvest technology refers to all treatments or procedures applied from the time of harvest to consumption of products. Preventing post harvest losses is generally less costly than producing an equivalent amount of agricultural crops, especially fruits and vegetables. Various technologies are available to extend the shelf life of agricultural produce:

A. Waxing

Waxing forms a protective layer on fruits and vegetables, reducing moisture loss and respiration rates while extending storage life.

B. Evaporative Cool Storage

This is an ideal method for short-term storage of crops at the farm level, particularly for perishable crops. It also reduces shrivelling and increases the storage life.

C. Pre-packaging

This technology regulates the rate of respiration and transpiration, keeping the products fresh at both room temperature and low temperature. Because of its low cost and availability, it can bring benefits for both the consumers and producers.

D. Cold Storage

Cold storage extends the storage period by lowering the rate of respiration and delaying ageing.

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E. Modified Atmosphere Packaging (MAP)

This technology modifies the atmospheric inside packaging to extend shelf life. For instance,

- ❖ MAP can increase the shelf life of green chillies, cavendish bananas, and sweet peppers (capsicum) by 8, 15, and 13 days, respectively.
- ❖ Storing papayas in a low density polyethylene (LDPE) bag at 10-12 °C under modified atmosphere (MA) conditions can extend storage time by 4 weeks.

F. Controlled Atmosphere (CA) Storage

The principle behind it is to create and keep a storage room with controlled environment which has higher concentration of CO₂ and lower concentration of O₂. This slows down the rate of respiration and delaying ageing. It is more efficient when used in combination with low temperature storage.

G. Cold Chain

A cold chain involves performing a sequence of operations in a controlled low temperature environment to transport fresh agricultural commodities from farm to consumer. It aids in minimizing wastage and maintaining the quality of crops.

H. Irradiation

When ionizing radiation (such as gamma rays) is applied to fruits and vegetables at the right dosage level, it can delay ripening, reduce insect damage, and prevent microbiological contamination and sprouting and rotting in tuber and bulbous crops like garlic, onion, and potatoes during storage. It also works as disinfectant and kills pests like papaya fruit fly, mango seed weevil, and citrus fruit fly.

I. Edible Coatings

Edible coatings made from lipids, proteins, and polysaccharides serve as food wraps and turn into food ingredients when consumed with food. Their advantages are as follows:

- ❖ An edible coating enhances structural integrity, improves mechanical handling, maintains the quality and reduces microbial damage.
- ❖ It controls immigration of gases and moisture exchange, and retains volatile flavour compounds.

**J. Others**

Other services for perishables crops (like fruit and vegetables) at the farm level include harvesting, washing, cleaning, grading, packaging and value addition.

- ❖ Value addition must ensure higher returns for producers and farmers while delivering better product quality to consumers.
- ❖ Appropriate packing materials should be used for both the export of fresh produce and modified atmosphere packaging.
- ❖ It will be beneficial to create novel food alternatives like fibre, single-cell proteins, and enzymes from byproducts of food processing industries.

Proper infrastructure with facilities for sorting, grading, packaging, and post-harvest handling must be developed in all important markets and farmers must be well trained for effective management of agricultural produce during the post harvest phase.

**INTEXT QUESTIONS 12.3**

1. Maximum amount of post harvest losses is observed at
 - a. Farmers' field
 - b. Packaging
 - c. Storage
 - d. Transportation
2. The technique of applying ionizing radiation to fruits and vegetables is termed as
3. Which of the following materials is used to prepare edible coating for food wrap?
 - a. Lipid
 - b. Protein
 - c. Polysaccharide
 - d. All of the above
4. State whether the following statements are true or false.
 - a. Higher concentration of O_2 and lower concentration of CO_2 are maintained in controlled atmosphere storage.
 - b. Evaporative cool storage is ideal method to store crops for a shorter period of time.

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Notes**WHAT YOU HAVE LEARNT**

- Post harvest management focuses on preserving, processing, and adding value to agricultural produce to enhance its economic viability. The quality, duration of storage, and shelf life of agricultural crops can be improved by post harvest management system.
- The post harvest management system for agricultural produce includes production, protection, processing, packaging, distribution, marketing, and utilization as components of the post harvest chain aimed at fulfilling the population's nutritional needs.
- Major reasons for post harvest loss include poor planning, inadequate storage facilities, lack of good quality infrastructure and cold chain, inadequate packaging operations, limited awareness, insufficient technical support, knowledge gaps between lab and land, an unorganized market and insufficient marketing services.
- Advanced post harvest technologies like waxing, edible coatings, irradiation, evaporative cool storage, modified atmosphere packaging or controlled atmosphere storage may be employed to reduce post harvest loss.

**TERMINAL QUESTIONS**

1. What is the importance of post harvest management?
2. Explain the causes of post harvest losses of agricultural produce.
3. Describe the types of losses that occur during post harvest handling.
4. Enlist and explain various steps in the post harvest management system of an agricultural produce.
5. Discuss the negative effects of post harvest loss.
6. Write a short note on following topics
 - a. Modified atmosphere packaging (MAP)
 - b. Edible coating
 - c. Controlled atmosphere storage

**ACTIVITY**

Imagine you are managing a kitchen storeroom at your home, where various food items such as grains, fruits, vegetables, spices, bread, jam, jelly etc. are stored. Discuss the potential risks associated with pest and disease infestation during storage and outline a strategy to mitigate these risks effectively.

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**ANSWERS TO INTEXT QUESTIONS****12.1**

1. Post Harvest Loss
2. Tender texture (option d)
3. Mechanical loss, metabolic loss, pathological deterioration and poor storage facility

12.2

1. Quantitative and qualitative
2. Colour and texture

12.3

1. Transportation (option d)
2. Irradiation
3. All of the above (option d)
4. a) False b) True

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GLOSSARY

Bruising: Bruising refers to the formation of larger, flattened areas on freshly harvested produce. A bruised fruit indicates cellular damage caused by its rough handling during harvest or post harvest phases. A major symptom of cellular damage due to bruising is internal browning.

Blanching: Blanching is a technique used to preserve the quality of vegetables before freezing. In this process, vegetables are heated in boiling water for a short period of time to stop enzymatic activity within it. However, it causes loss of nutrients, especially water soluble vitamins.

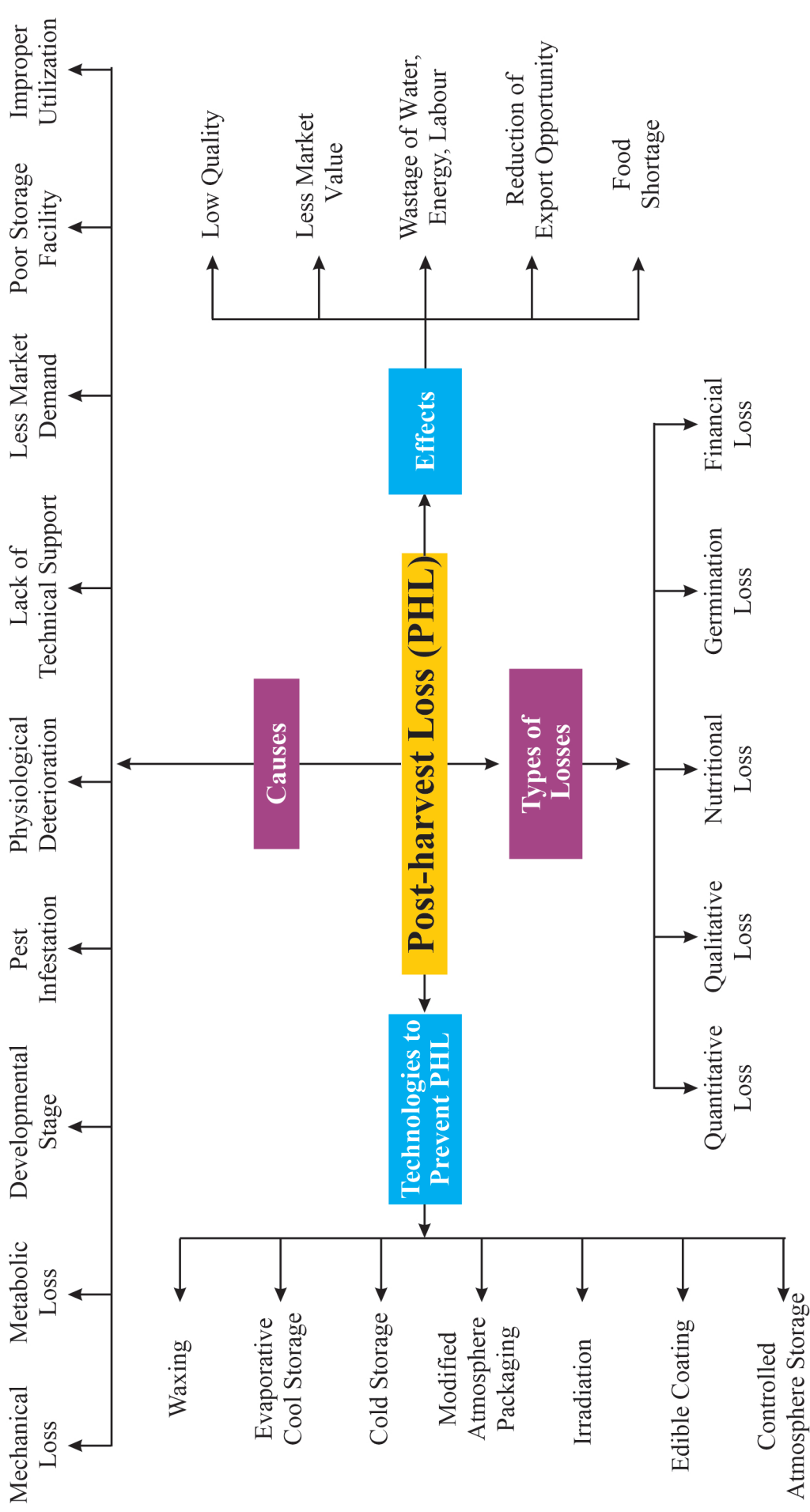
Pitting: This is the process of formation of small sunken area/pits on the surface of fruit. Pitting is primarily caused by mechanical impact or compression.

Ethylene: Ethylene is a gaseous plant hormone which plays a vital role in the ripening of fruits. An unripe fruit contains very little amount of ethylene. As the fruits matures, the production of ethylene increases, inducing the ripening process.

SUGGESTED READINGS

1. Simson, S. P. (2014). *Post Harvest Technology and Management*, Oxford Book Company, India.
2. *Importance of Post-harvest Management and Value Addition of Fruits and Vegetables*, Agricorn. (<https://www.agricorn.in/2023/08/post-harvest-processing-fruits-vegetables>)

WHAT YOU HAVE LEARNT





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