

## Improving Vegetables Freshness: Smart Post-Harvest Tips

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### Introduction:

In developing countries, where 52% of the world's arable land is concentrated and 74% of the world population lives, only 40% of the world's foodstuffs are produced. Vegetable crops, in this scenario, can play a very important role in tackling the problem of hunger and nutrition, because these can give very high production of protective nutrients. These are critical, irreplaceable dietary component, not just a side dish to add flavour, but break the deficiency cycle and produce healthy populations able to work and learn. Post-harvest management of vegetables is an essential aspect of vegetable production. It involves a series of activities that are carried out after harvesting the vegetables from the farm. These activities are aimed at maintaining the quality and freshness of the vegetables, reducing losses, and increasing their shelf life. Post-harvest management of vegetables is critical because it determines the value of the produce in the market and the income that farmers can earn from their crops as vegetable are rich source of carbohydrates, proteins, mineral, vitamins and rich source of protective substances.

### Nutritive value of vegetables:

|          | Energy (Kcal) | Protein (g) | Fat (g) | Mineral (g) | Carbohydrates (g) | Fiber (g) | Calcium (mg) | Phosphorus (mg) | Iron (mg) |
|----------|---------------|-------------|---------|-------------|-------------------|-----------|--------------|-----------------|-----------|
| Brinjal  | 24            | 1           | 9       | 9           | 4                 | 1         | 18           | 47              | 0         |
| Cucumber | 13            | 0           | 0       | 0           | 2                 | 0         | 10           | 25              | 1         |
| Tomato   | 23            | 2           | 0       | 1           | 4                 | 1         | 20           | 36              | 2         |

|               |    |   |   |   |   |   |    |    |   |
|---------------|----|---|---|---|---|---|----|----|---|
| Pumpkin fruit | 25 | 1 | 0 | 1 | 5 | 1 | 10 | 30 | 0 |
| Onion stalks  | 41 | 1 | 0 | 1 | 9 | 2 | 50 | 50 | 7 |

(Source: ICMR)

### Reasons for Postharvest losses

Factors which are responsible for post-harvest losses vary from place to place and become more and more complicated. The following reasons for postharvest losses are as under: -

- Moisture loss causing wilting.
- Loss of photosynthates like carbohydrates, proteins occur.
- Physical damage through pest and diseases attack.
- Physiological loss causing decrease in degree of excellence.
- Fibre development
- Greening in potato
- Microbial causes by insects and rodents
- Activity of enzymes of the plant or food

### Post-harvest management practices:

- **Selection of varieties:** Varieties that has better quality, processing is selected for breeding. A few examples of varieties with long shelf life are Arka Vishal, Pusa Gaurav (Tomato), Arka Nidhi (Brinjal).
- **Harvesting:** The timing of harvesting is critical in vegetable production. Vegetables should be harvested at the right time to make certain that they are at their greatest standard. Overripe or under ripe vegetables have a shorter shelf life and may not be as nutritious as those harvested at the right time. The harvesting process should be delicate to avoid bruising or damaging the vegetables.

### Examples:

#### Tomato:

1. **Dark green colour-** Dark green colour is changed and a reddish pink shade is noticed on fruit. Such fruits are then sprayed with ethylene 48 hours prior to transport. Immature green tomatoes will ripen poorly and be of low quality. A simple way to direct maturity is to slice

the tomato with a sharp knife. If seeds are cut, the fruit is too immature for harvest and will not ripen properly.

2. **Breaker stage-** Dim pink colour observed on  $\frac{1}{4}$  part of the fruit. Fruits are harvested at this stage to ensure the best quality. Such fruit are less vulnerable to damage during shipment often pick up a higher price than less mature tomatoes.
3. **Pink stage-** pink colour observed on  $\frac{3}{4}$  part of the fruit.
4. **Reddish pink-** Fruits are rigid and nearly whole fruit turns reddish pink. Fruits for local sale are harvested at this stage.
5. **Fully riped-** Fruits are fully riped and soft having dark red colour. Such fruits are used for processing

**Lettuce:** Harvest leaves when they are young and tender for the best flavor.



**Sorting and grading:** After harvesting, vegetables should be sorted and graded according to their size, shape, and quality. This process helps to take out injure, diseased, or low-quality vegetables, which can affect the overall quality of the produce.

**Potatoes:**

Sort based on size, removing any damaged or spoiled ones. Group them by size, such as large, medium, and small.

**Carrots:**

Sort by size and shape, removing any with deformities or damage. Grade based on length and diameter.



**Cleaning:** Vegetables should be cleaned thoroughly to remove any dirt, debris, or foreign matter that may have gathered during harvesting. This process helps to decrease the possibilities of impurities and spoilage.

**Cooling:** Cooling is an essential post-harvest management practice that helps to slow down the rate of respiration and microbial growth in vegetables. Rapid cooling is crucial for maintaining the quality and freshness of the produce.

- **Leafy Greens (Lettuce, Spinach):** Ideally, store at temperatures around 32°F to 40°F (0°C to 4°C).
  - **Broccoli and Cauliflower:** Store at temperatures between 32°F to 40°F (0°C to 4°C).
- Carrots: Keep at temperatures near 32°F (0°C) with high humidity.

**Waxing:** Vegetables such as tomato, sweet pepper, cucumber, muskmelon, carrot etc. are often waxed with a water combination by dipping or spraying to delay the moisture loss from the product and at the same time to improve their shine. This practice of keeping the product sound and lustrous is generally not in trend in our country.

- **Cucumbers:** Waxing helps maintain moisture and appearance, preserving freshness.
- **Bell Peppers:** Waxing can improve the shine and appearance of bell peppers, reducing dehydration.
- **Eggplants:** Waxing helps prevent moisture loss and maintains a glossy appearance.

**Packaging:** Proper packaging is crucial in vegetable production. Packaging materials should be clean, dry, and free from any contaminants. The packaging should also be suitable for the type of vegetable being packed to prevent damage or spoilage.

#### **Broccoli and Cauliflower:**

Bundle up in aerable plastic or place in permeable bags. Avoid airtight packaging to prevent moisture growth.



#### **Tomatoes:**

Pack in sturdy, crush-resistant boxes or baskets. Avoid stacking too many layers to prevent bruising.





**Storage:** Proper storage conditions are essential in vegetable production. Vegetables should be stored in cool, dry, and well-ventilated areas to prevent spoilage. The storage area should be free from pests and other contaminants that can affect the quality of the produce.

- **Carrots:** Store in the refrigerator in a perforated plastic bag or in the vegetable crisper. Keep them cool and humid.
- **Tomatoes:** Store at room temperature until fully ripe, then refrigerate to slow down further ripening. Bring back to room temperature before consuming for better flavor.
- **Bell Peppers:** Refrigerate in the vegetable crisper, preferably in a perforated plastic bag. Keep them cool and dry.

**Transportation:** Proper transportation is critical in vegetable production. Vegetables should be transported in clean, well-maintained vehicles that are free from contaminants. The temperature inside the vehicle should be controlled to prevent spoilage.

- **Bell Peppers:** Transport in well-ventilated crates or containers. Avoid overcrowding to prevent friction.
- **Potatoes:** Transport in well-ventilated containers, such as crates or mesh bags, to prevent moisture buildup and sprouting

#### **Advanced methods for post-harvest management of Vegetables:**

- **Intelligent packaging:** This technique indicates the freshness of the produce by changing colors, so that consumer can know its quality and can check it if any decay occurred during the transport. Time –temperature integrators are instruments that display irreversible changes in parameters such as shape or color.
- **Irradiation** It is exposure of fruits and vegetables to ionizing radiations from radioactive sources under the controlled conditions to disinfect, to sanitize and protect the produce. It is also called as cold pasteurization. These radiations differ in wavelength, frequency, penetrating power.

#### **Sources of irradiation:**

- Gamma rays from radioisotopes such as cobalt-60 or cesium-137.
- X-rays from machine sources operated at or below energy level of 5Mev.
- Electrons generated from sources operated at or below an energy level of 10Mev.

#### **Controlled / Modified atmosphere storage:**



In this system, the product is held under atmosphere conditions modified by package, overwrap, box liner or pellet cover. The first requirement of CAS is sufficiently gas-tight envelopes around the product and the second requirement is some medium of regulating the concentration of CO<sub>2</sub> and O<sub>2</sub> at the desired level.

### Revolutionizing the Future

- **Smart Farming and Precision Agriculture:** Future advancements in smart farming technologies will play a vital role. Integrating sensors, drones, and AI-driven analytics into vegetable cultivation help farmers to monitor and manage crops more accurately. Real-time data on environmental conditions, soil health, and crop status allow for precise decision-making, optimizing harvest timing for extended freshness.
- **Sustainable Packaging Innovations:** Future packaging solutions will not only protect vegetables during transportation but also contribute to their shelf life. Biodegradable and eco-friendly packaging materials will become more frequent, reducing environmental impact while maintaining the cleanliness and quality of vegetables.
- **Nanotechnology for Preservation:** Nanotechnology offers exciting plan for vegetable preservation. Nano-coatings and films can be applied to vegetables, creating a protective obstacle against moisture, microbes, and gases. This not only extends shelf life but also decreases the need for chemical preservatives.

### Conclusion

Post-harvest management of vegetables is a critical aspect of vegetable production. It involves a series of activities that are aimed at maintaining the quality and freshness of the produce, reducing losses, and increasing their shelf life. Proper post-harvest management practices can help farmers to earn more income from their crops and contribute to food security.

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