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A REVIEW

# Horticultural crops - Post harvest losses and heat treatment- A Review

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India is blessed with variety of agro climatic condition favouring the production of varied fruits and vegetables. India has become the second largest producer of fruits and vegetables in the world. But the recent survey shows that in India, about 25-40 per cent of total fruits and vegetables produced annually are being lost due to poor post harvest practice, which causes reduction in net per capita availability of fruits. Hence, it may not be necessary to step up production of fruits with growing demand if post harvest loss is reduced to a great extent.

Post harvest decay is the major factor limiting the extension of storage life of fruits and vegetables. The use of chemical treatments for fruits and vegetables to control insects and diseases to extend storage life are potentially harmful to humans, so it has led interest in the use of alternative, non chemical treatments. Hence, there is a need to develop effective, non-destructive physical treatments for insect disinfestations and disease control in fresh horticultural produce. Heat treatment is one among the possibilities being explored. It is an effective physical treatment for insect disinfestations and disease control in fresh fruits and vegetables.

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**Outcome of post harvest losses:**

– Complete product loses

– High costs will be involved during production and low profits during sales

– Loss of market opportunities, may be domestic or international

– Low competitiveness

**Post harvest loss occurs in terms of:**

– Economical loss which refers to reduction in monitory value as a result of physical loss

– Quantitative loss which includes reduction in weight by moisture loss and loss of dry matter by respiration.

– Incidental loss in terms of quality of food.

– Qualitative loss which refers to loss of consumer appeal.

– Nutritive loss which includes loss in vitamins, minerals, sugars, etc.

**Reasons for post harvest losses:**

– Physiological processes

– Pathogens

– Insect infestation

These are the three main reasons causing post harvest losses among these insect and pathogen are the ones which cause serious loses.

**Table 1: Area and production under horticultural crops in India**

| Crops | Area (ha) | Production (MT) | Productivity (MT/ha) |
|---|---|---|---|
| Vegetables | 7803 | 125887 | 16.1 |
| Fruits | 5775 | 63503 | 11.0 |
| Plantation crops | 3226 | 12045 | 3.7 |
| Spices | 2603 | 4103 | 1.6 |
| Flowers | 161 | 870 | 5.4 |
| Medicinal and aromatics | 386 | 325 | 0.8 |
| Total | 19954 | 206733 | 10.3 |

NHB Database, 2008

**Table 2 : Major post harvest diseases of some fresh fruits and vegetables**

| Crops | Disease | Pathogens |
|---|---|---|
| Apple and pear | Grey mould | *Botrytis cinerea* |
| Banana | Crown rot | *Colletotrichum musae, Fusarium roseum* |
| Citrus fruit | Green mould | *Botrytis cinerea* |
| Mango and papaya | Anthracnose | *Colletotrichum gloe* orioides |
| Strawberry | Grey mould | *Botrytis cinerea* |
| Bell pepper | Soft rot | *Erwinia* sp. |
| Potato | Bacterial soft rot | *Erwinia caratovora* |
| Sweet potato | Black rot | *Ceratocystis fimbriata* |
| Leafy veg. and carrot | Watery soft rot | *Sclerotinia sclerotiorum* |

**Mode of entry for insect and pathogens:**

The insect and pathogens gain entry through various means which are listed below

- Natural openings
- Stress induced openings
- Direct penetration(some fungi)
- Wounds(insect)

**Mechanical damage:**

To reduce post harvest loss different methods are tried out, among them use of post harvest heat treatment is described here.

**Heat treatment:**

Heat treatment is the application of heat at temperatures above $40^0$C for control of post harvest insect and pathogens (Aborisade and Akomolafe, 2007; Chen and Pan, 2006).

**Types of heat treatment:**

- Hot water treatment
- Hot air treatment
- Vapour heat treatment

**Hot water treatment:**

Here in this method crops are immersed in hot water before storage or marketing to control diseases. Treatment is generally utilized for fungal pathogen control, since fungal spores are either on surface or in first few cell layers under the peel of fruit and vegetables. Recommended condition is 51-$55^0$C for 30 min for effective control of diseases. Diseases which can be successfully controlled by this way is anthracnose and stem end rot. Hot water treatment has been effective in papaya fruit rot disease (Nishijima, 1995). Hot water treatment extends the self life of fruits (Waskar, 2005). However, it requires the use of specialized equipment because temperature control of the water bath is essential for the process to be effective and for prevention of damage to the fruit.

**Vapour heat treatment:**

This treatment was developed to control insect infections after harvest It consists of stacking the boxes of fruits in a room which is heated and humidified by injection of steam. Vapour method is a method of heating fruit with warm air saturated with vapour between $40^0$C- $50^0$ C for 8 hours depending on the crop and variety.. The temperature and exposure time are adjusted to kill all stages of insects .There are 3 phases warming period, can be faster or slower depending on a commodity sensitivity to heat. The warming period is followed by holding period; it is when the internal temperature reaches the desired level to kill the insect. The last phase is cooling period, which can involve air cooling (slow) or hydro cooling. Steam treatment had been found effective in preventing carrot decay during storage (Afex *et al.*, 1999).

**Hot air treatment:**

Hot air can be applied by placing fruit or vegetables in a heated chamber with a ventilating fan or by applying forced hot air during which the speed of air circulation is precisely controlled. Treatments using air ranges from 43-$54^0$C for 10-60 minutes. It can be used for both fungal and insect control (Nishijima, 1995). It has been found effective in maintaining quality of fresh cut broccoli florets driving storage in refrigerator (Lemonie *et al.*, 2009).

**Advantages of heat treatment:**

- It ensures better shelf life of the produce
- Reduced instance of post harvest loses
- Fetches better export value for the produce in the market
- Most importantly it is eco-friendly in nature.

**Disadvantages of heat treatment:**

- Sometime causes heat injuries and discoloration of produce
- High cost and time involved

– It requires the use of specialized equipment to control temperature for the process to be effective and for prevention of damage to the fruit.

**Conclusion:**

Heat treatment of fresh fruits and vegetables can provide good control of decay. Heat treatment has the added benefit of reducing the sensitivity of the commodity to chilling injury, thus extending the storage life by preventing both pathogens and insects. Reduces human health hazards. Heat treatment offers a best alternative for disease or insect disinfestations. But one of the drawbacks of this treatment is high cost and time involved. Hence, commercial viability of this heat treatment depends on the innovations that reduce both the time and cost involved in it. With continued effort, heat treatment offers a best alternative for disease or insect disinfestations.

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