

PRE AND POST HARVEST TREATMENTS FOR PAPAYA AND BANANA

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Abstract

India is the second largest producer of the fruits. Most of the fruit are perishable in nature so those are easily spoiled and loss in quality. Papaya and Banana are climacteric and perishable fruits. High respiration rate, ethylene production and physiological loss in weight leads to deterioration in quality of fruits. The pre harvest and post-harvest loss is about 10-12% and 40-60% respectively. So, it becomes necessary to find out suitable pre and post-harvest solutions to extend shelf life and quality of papaya and banana. Various technologies have been developed to improve shelf life and quality of fruits. Pre harvest treatments such as a foliar spray of chemicals, proper method of harvesting, mulching, thinning, fertilizers, judging the stage of maturity, etc. and post-harvest treatments like pre cooling, washing, dipping, wrapping, coating, storage, packaging are used for improving the shelf life and quality of papaya and banana.

Keywords: Pre harvest treatment, post-harvest treatment, papaya, banana

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Introduction

Papaya (*Carica papaya* L.) is one of the most popular fruits which belong to family Caricaceae. It is native of Tropical America but it is now grown in all tropical and subtropical countries of the world. It is also known as 'Pawpaw', 'Backyard Fruit', 'Tree Melon' and 'Breakfast Fruit'. Banana (*Musa paradisiaca* L.) is one of the most popular fruits which belong to family Musaceae. It is native of South East Asia. It is grown in all tropical countries of the world. It is also known as 'Adam's fig', 'Tree of wisdom', 'Tree of paradise', 'Kalpataru' and 'Apple of paradise'.

Causes of fruit loss:

- ❖ Delicate in nature so heavy spoilage.
- ❖ Climacteric Fruit
- ❖ Rapid metabolic activities
- ❖ Mechanical injury
- ❖ Disease pest incidence
- ❖ Lack of storage facilities
- ❖ Harvesting at improper stage

What are pre harvest treatments?

Treatments or applications that are given before the harvesting of fruit for improving their quality and shelf life are known as pre harvest treatments. Advantages of pre harvest treatments are; Increases fruit yield, Fruit firmness, Color development, Reduces physiological loss in weight, Increases the storage life

Methods of Pre Harvest Treatment:

- 1. Foliar Spray:** Nutrients or growth regulators can be applied to the leaves as sprays in a process is known as foliar application. Advantages of foliar spray1. Only use small amount of fertilizer2. Improved yield and fiber quality parameters.
- 2. Fertilizers:** Fertilizers are materials that supply the essential elements in readily available form for plant use. Ex. N, P, K, Ca, Mg, S. Every plant has basal dose of fertilizer or nutrients. Fertilizers help in proper growth of plant and quality management of fruits.
- 3. Methods of Harvesting:** The method of harvesting can also have significant impact on the composition and post-harvest quality of fruits. Sharp tools/secateurs/harvester/hand gloves/digger/vibrator/trimmer any such items should always be used to detach the fruits from the mother plant. Management of harvesting operations, whether manual or mechanical, can have a major impact on the quality of harvested fruits. Proper management of methods of harvesting helps to improve self-life and quality of fruits.
- 4. Stage of Maturity:** Stage of maturity can also affect final quality, when fruits are harvested too late or too early in the season, overall taste, texture, and color may be compromised. Maturity at harvest is therefore an important factor that determines the

final quality of the produce. Stage of maturity of fruits at immature stage leads to both qualitative and quantitative losses. Immature fruits fail to ripen normally with low nutritive values and have inferior flavor quality when ripe. On the other hand over mature fruits are likely to become soft and mealy with insipid flavor soon after harvest.

- 5. Time of Harvest:** It is advisable to harvest produce when temperature is mild as high temperature causes rapid respiration rate and excessive water loss. The recommended time for harvest of fresh horticultural produce is early morning hours or late evening hours.
- 6. Thinning:** Removal of extra flowers fruits or leaves to avoid injury due to over crowding. Advantages of thinning are Increase fruit size, Increase fruit quality like; increase Sugar & acid ratio, Increases ratio of fruit flesh, Increases edible portion.
- 7. Plastic bag cover in banana:** In banana bunch is covered by different bags that improve quality, appearance and protect from birds and pests. Available in different forms, colors and makings.
- 8. Bunch feeding in Banana:** The technology of enhancing the size of fingers of banana in the bunch to suit the market demands by De-navelling and Post-shooting feeding of N, K and S through the distal stalk end of rachis was successfully developed.
- 9. Pruning:** Leaves of the banana plant need to be pruned regularly. Type of leaves to be pruned; 1. Dead leaves 2. Diseased leaves 3. Too close to the fruit bunch Advantages are to avoid fruit damage (bruising) and to enable free air circulation around the developing fruits.
- 10. Mulching:** Mulching is the process of covering soil around the plants with an organic or synthetic material to create congenial condition for the plant growth, development and efficient production. Advantages are Protects soil from drying & hard baking effects, It breaks the force of rain & irrigation water, It prevents weed growth, It improves quality of fruits, Reduce soil erosion, Reduce the soil temperature.

Type of Mulch

Organic Mulches: organic mulches degrade easily and they are locally available usually and are on-farm produced. There is no issue of post utilization handling. For example – Leaves, Straw, Grass etc.

Synthetic Mulches: Synthetic mulches are synthesized ones and they need prior work before use them in the field. They are easily available, easy to handle, transport. For example – Plastic mulch.

What is Post Harvest Treatment?

Methods and techniques applied after the detachment of the fruit to increase the shelf life and quality. Advantages are Maintains the quality of fresh fruits, Increases the market share and competitiveness of smallholders, Improves human nutrition and health, Stimulates agriculture production, Provides extra food to the consumer by reducing post-harvest losses

1. Pre Cooling: Pre-cooling refers to removal of field heat (quick cooling) after harvest; if not, its deterioration is faster at higher temperature of 1 hour at 32°C = 1day at 10°C or 1 week 0°C. Types of pre cooling are A. Cold air 1. Room cooling 2. Forced air cooling (pressure cooling) B. Cold water / Hydro cooling C. Top Icing- direct contact with ice D. Evaporation of water from produce E. Hydro vacuum cooling- combination of hydro and vacuum cooling

I. Room Cooling: In room cooling, heat is transferred slowly from the mass of the produce (by convection) to the cold air being circulated around the stacked containers. This is most common and widely used method. Here cold air is passed from the fan and cool by convection process. Its commonest use is for products with relatively long storage life and marketed soon after harvest. Advantage of this room air-cooling is that produce can be cooled and stored in the same room without the need of transfer and hence it is economical

II. Forced air Cooling (pressure cooling): In this system 'cold air is passed by force from one side to other side using big fan'. Cold air movement is through the containers rather than around the containers. Cooling is 4 to 10 times more rapid than room cooling and its rate depends on airflow and the individual volume of produce.

- 2. Cleaning and Washing:** cleaning is a treatment given to remove adhering dust, extraneous matter, pathogenic load etc. from the surface of commodity. It improves appearance of fruits. Washing of fruit is done to remove dirt, insects, molds and sometime spray residues. Washing helps in extending the self-life of fruits. Chlorine is use act as a sanitizer.
- 3. Sorting and Grading:** sorting may be done manually or by using a machine. Fruits are graded on the basis of their color, size and weight and sorted for freeness from damage/diseases. Grading can be done manually or by automatic grading lines. Size grading can be done subjectively (visually) with the use of standard size gauges. Round produce units can be easily graded by using sizing rings.
- 4. Chemical Treatment:** Various chemicals are applied to fruits in order to control postharvest diseases and pest infestations. Different methods of chemical applications are; Dipping, Cascade application, Electrostatic sprays, Dusting, Fumigation and Chemical pads.
- 5. Hot Water Treatment:** Dipping of fruits in hot water of specific temperature for specified periods for the purpose of disease control, insect disinfestations or uniform ripening' is known as hot water treatment.
- 6. Waxing:** A protective edible coat on fruit which protect them from transpiration losses and reduce the rate of respiration is called waxing.
- 7. Irradiation:** Radiation can be applied to fresh fruits to control micro-organism/insects/parasites and inhibit or prevent cell reproduction and some chemical

changes. It can be applied by exposing to gamma-rays, X-rays and others. Radiation doses are measured in Grays (Gy). One Gray = 100 rads. Different doses of irradiation are Low dose application (up to 1 kGy) Medium dose application (1 kGy to 10 kGy) and High dose application (above 10 kGy) Scope of irradiations are Disinfestation, Shelf life extension, Decontamination, Product quality improvement

- 8. Degreening:** Post-harvest treatment of fruits with ethylene under controlled conditions hastens the loss of chlorophyll, a process known as 'Degreening'. Degreening consists of chlorophyll degradation to allow the expression of natural pigments masked by the green color. E.g. yellowing of banana fruits.
- 9. Ripening:** During ripening an inedible mature fruit will turn into edible soft fruit with optimum taste and characteristic flavor. Fruits start ripening after reaching maturity by release of a ripening hormone known as ethylene from the fruit. During this ripening process fruits attain their desirable color, flavor, quality and other textural properties. Manipulating the ripening is important in extending the shelf life and ensuring appropriate quality of fruit to the consumer. Recent development of new chemicals like 1-methylcyclopropene (1-MCP) provides a new approach for manipulation of ripening and senescence. The beneficial effects of 1-MCP in fresh produce include the inhibition of respiration and ethylene production, delayed fruit softening and restricted skin color changes, prolonged cold storage life.
- 10. Storage:** Many horticultural crops are seasonal in nature and have a relatively short harvesting season and they are highly perishable. Hence, proper storage of these produce using appropriate methods would prolong their availability. Storage of fresh produce will also be helpful in checking market glut, providing wide selection of fruits to the consumer through most part of the year i.e. especially during the off season. Proper storage also aims at controlling disease infection and preserving the commodity in its best quality for consumers. The goals of storage are; Slow down biological activity, Reduce product drying and moisture loss, Reduce pathogenic infection, Avoid physiological disorders, Reduce physical damage, Increase the shelf life of fruits
- 11. Packaging:** Packaging is the art and technology of enclosing or protecting products for distribution, storage and sale. Benefits of packaging are Packaging serves as an efficient handling unit, It serves as a convenient storage unit, Packaging protects quality and reduces waste, Protects from mechanical damages, Protects against moisture loss, May provide beneficial modified atmosphere, Provides clean produce, Provides service and sales motivation, Reduces cost of transport and marketing and Facilitates use of new modes of transportation. Different types of packagings are Bundle Volume/Box packing, Package insert, Bags: gunny bag, plastic bag, jute bag, Punnet packing and Foam sleeve. Different packaging materials are Bamboo basket, Straw, Palm leaves, Natural and synthetic fibers, Wooden boxes, Wire bound crates, Corrugated fiber board box, Biodegradable packaging materials, Plastic material and Others.

12. Transportation: The basic requirements during transportation are better control of temperature, humidity and adequate ventilation. Refrigerated containers and trailers are more often used for long distance shipping, whether by sea, rail or truck.

Related Studies:

Yadav *et al.* (2014) obtained highest ascorbic acid and total sugar in fruits of Madhubindhu cultivar by spraying of GA₃ (15 ppm) and carbendazim @ 0.05% at 15 days before harvesting.

Yadav *et al.* (2014) recorded the highest ascorbic acid and total sugar in fruits of Madhubindhu cultivar by dipping them in GA₃ @ 15ppm for 5 minutes.

Bhalerao and Patel (2015) found that spraying of calcium nitrate 1000 mg/l + borex 30 mg/l + zinc sulphate 200 mg/l + ferrous sulphate 200 mg/l at 60, 90 and 120 days after planting gave the highest TSS, reducing sugar, total sugar and shelf life of papaya fruit cv. Red Lady.

Pathak *et al.* (2017) found the highest finger length, finger girth, finger weight and finger volume, harvest index in white non-woven polypropylene bag.

Balkic *et al.* (2018) studied that the highest bunch weight, low peel thickness, peel ratio (%) and high soluble solid (%) in white net mulching and highest fruit firmness in clear plastic mulch.

Krishna *et al.* (2018) reported that the dipping of Arka Prabhat fruits in CaCl₂ @ 2% + citric acid 5 % for 5 minutes improves TSS, total sugar and decreases spoilage.

Millik *et al.* (2018) observed that the highest result of 500g fresh cow dung + 7.5g urea + 7.5g K₂SO₄ on all growth characters of banana.

Badway and Ali (2019) observed that the highest result in fertilizer treatment of 75% RD + 21 kg compost + 5 ml biofertilizer /plant on quality characters of banana.

Martha *et al.* (2019) observed that the highest physiological weight loss in open ground condition and lowest physiological weight loss of banana observed in plastic bag packaging materials.

Conclusion

Pre and post-harvest treatments increase the quality and shelf life of fruits. Pre harvest treatments like foliar spray of borex (30mg/l), ZnSO₄ (200mg/l), FeSO₄ (200mg/l), GA₃ (15 ppm), fertilizer application in combination with spraying of novel organic liquid nutrient (1%) and harvesting at the colour break stage found effective for better quality and prolong shelf life of papaya. In banana pre-harvest treatments like bunch cover with white non-woven polypropylene bag, mulching with white net and organic nutrients like vermicompost 6 kg/plant found effective for better quality and prolong shelf life of banana. Post-harvest treatment of hot water, post-harvest spray of GA₃ (15 ppm), CaCl₂ (2-3 %), wrapping with newspaper and paddy straw had positive effect on quality and shelf life of papaya. In banana post-harvest treatments like washing, packaging with plastic bag, post shooting spray of SOP (1.5%) and low temperature storage can enhance the shelf life and quality of banana.

References

- Badawy, H. E. M. & M. E. Ali (2019). Effect of some fertilization treatment on growth, yield, fruit quality and nutrition status of banana cv. grand naine. *Annals of Agricultural Sciences, Moshtohor*, **57**(1): 89-98.
- Balkic, H; Gubbuka, I. Tozlu & L. Altinkaya (2018). Effect of inorganic mulching on morphological features, quality and yield of banana. *Acta Horticulture*, 1196-20.
- Bhalerao, P. P. & Patel, B. N. (2015). Effect of foliar application of Ca, Zn, Fe, and B on growth, yield and quality of papaya var. Taiwan Red Lady. *Indian Journal Horticulture*, **72**(3): 325-328.
- Krishna, V. N. P. S.; Rao, A. V. D. D.; Giridhar, K. & Latha, P. (2018). Quality and shelf lifeevaluation of minimally processed papaya using chemical treatments. *International Journal of Pure Applied Bioscience*, **6**(1): 1276-1282.
- Martha Mebratu & Daniel Muneda (2019). Effect of different packaging materials on shelf lifeof Banana (*Musa paradisiacal* L.). *International Journal of Life Science*, **9**(1)(ISSN : 2277-193x).
- Millik, T. T.; Kartik Baruah; Vikash Kumar & Nishant Barik (2018). Effect of bunch feeding ofN and K on yield character in banana cv. Barjahaji. *Current Journal of Applied Science and Technology*, **26**(1): 1-7; Article no. CJASt. 38889.
- Pathak, P.; Baruah, K.; Bhattacharya, R. K.; Kalita, P. & Baishya, B. K. (2017). Influence of bunch covers on yield of banana cv. Jahaji (AAA) under high density planting system. *International Journal of Pure and Applied Bioscience*, **5**(6): 1488-1493.
- Yadav, L.; Varu D. K.; Ghadage N.J.& Kore P. N. (2014). Effect of pre and post-harvest treatment on post-harvest quality of papaya. *Trends in Biosciences*, **7**(24): 4362-4368.