

SUMMARY AND CONCLUSIONS

CHAPTER V

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Papaya (*Carica Papaya* L.) is one of the most important fruit of India. It is produced throughout the year. Besides being liked for its exotic flavor and color it is rich source of vitamin A, B1, B2, and C, minerals, carbohydrates and carotenoids. Therefore papaya is important element for human nutrition. The nutritional importance makes papaya popular worldwide. It is highly perishable in nature. Hence, problem of it's storage and preservation warrants attention.

The papaya is highly susceptible for decay and rapid spoilage after harvesting. The decline in quality due to physiological disorder may be significant enough to cause complete rejection of the produce by consumer. The absence of adequate modern facilities for handling transportation and storage of papaya, the preservation causes loss of around 30 per cent, in some cases it exceeds 50 per cent.

In order to ensure better economical returns to growers and to reduce post-harvest losses, it is essential to develop suitable farm level appropriate and operationally feasible technology for storage and processing of papaya.

The present investigation was carried out at Department of Agricultural Processing Engineering, College of Agricultural Engineering and College of Agricultural Technology, Marathwada Agricultural University Parbhani during the year of 1999-2000. The summary of work done and conclusions drawn from the results of this investigation are presented below.

5.1 Standardization of maturity level of papaya.

In Maharashtra state, the area under papaya is increasing day by day. The farmers are inclined to grow papaya cv. Taiwan 786, for its high yielding ability and attractive size shape and color of the fruit. But due to inadequate information regarding standards of maturity for harvesting, the fruits are harvested before or after maturity, which creates problems in developing acceptable colour, flavor and test of fruit. Hence standardization of maturity level of papaya fruit cv. Taiwan 786 becomes important to minimize the losses during transportation, storage and processing. For standardizing the maturity level, following two methods were adopted.

1. Physical method
2. Days computation method.

In physical method the physical characteristics were assessed at each stage after 25 days of flowering up to 145 days with interval of 15 days. In days computation method, days required for maturity stage were predicated with the help of density and visual observation.

From physical method of standardization of maturity level of papaya following conclusions were drawn

1. The fruit length and breadth increases with the increasing age of fruit.
2. After 140-145 days of flowering fruits come to skin colour turning stage.

The fruit shows double sigmoid growth curve.

The fruit weight and volume increases from fruit setting to maturity.

5. Density of fruit, after 25 to 145 days of flowering varied within 0.761 to 1.04.

6. The pulp/peel and seed weight increases with increasing age of fruit.

7. The pulp/peel ratio gradually increases up to colour turning stage and then after it decreases.

From days computation method of standardization of maturity, conclusions obtained are as follows.

1. For longer shelf life and minimum losses in transportation the fruits must be harvested within 140 to 150 days after flowering.

2. For local market papaya fruit can be harvested within 150 to 160 days after flowering.

3. For table purpose fruits can be harvested within 160 to 170 days after flowering but there is a possibility of increase in the attack of fruit flies.

4. The papaya fruits are supposed to be physiological mature at 140 to 150 days after flowering and when they attain 1.04 to 1.048 g/cm density.

5.2 Chemical composition of papaya cv. Taiwan786

1)	Moisture (%)	89.9
2)	Total soluble solids (Brix)	10.1

3)	Acidity (%citric acid)	0.32
4)	pH	4.5
5)	Crude protein (%)	0.67
6)	Crude fat	0.11
7)	Total carbohydrates	9.02
8)	Ascorbic acid (mg/100g)	66.1
9)	Total sugars (%)	8.5
10)	Reducing sugars (%)	6.5

Form above observation it is concluded that papaya cv. Taiwan 786 is as good as any other papaya variety.

5.3 Effect of post harvest treatments on shelf life of papaya

Storage study of papaya (Cv. Taiwan-786) was conducted by using different treatments.

- T1 Wax emulsion coating (6 percent)
- T2 Intact film wrapper
- T3 Performed Polyethylene bags
- T4 Polyethylene bags without perforations
- T5 News paper wrapper
- C Control

The treated papaya fruits were stored at ambient temperature (25-28°C), refrigerated temperature (0-4°C), cold storage temperature ($8 \pm 1^\circ\text{C}$). During the investigation the effect of different treatment and storage temperature on storage behavior of papaya, physiological loss in weight (per cent), total soluble solids, percent titratable acidity, pulp peel ratio was observed and recorded. The results obtained can be concluded as below.

- 1) The initiations of ripening and spoilage was late in wax emulsion coating treatment and intact film wrap. The result of polyethylene bags with perforations, polyethylene bags without perforations and news paper wrap were slightly better than control.
- 2) The per cent physiological loss in weight was higher (20.04) in the control fruits at 12th day of storage, while the minimum per cent of PLW was found in wax emulsion coating treatments at 12th day of storage (2.41).
- 3) The effect of different treatments on the total soluble solids of papaya stored at ambient temperature was studied. All the treatments were good as compared to the control. There was no significant difference between the control and paper wrap regarding the increase in T.S.S.
- 4) Per cent titratable acidity of papaya stored at ambient temperature were studied. There was steady increase in titratable acidity in all treatments except control. This may be due to inhibition of ripening by all treatments. In control there was decrease in titratable acidity. The total titratable acidity was 0.24 per cent in case of wax emulsion coating at 12th day of storage.

- 5) Pulp/peel ration was affected by different treatments. All the treatments were superior over control. The fruits showed increase in pulp/peel ratio in all the treatments.
- 6) All the treatments were found to be superior as compared to the control in extending shelf life of papaya. (Cv. Taiwan-786)
- 7) The organoleptic evaluation of all the fruits was conducted regularly with the interval of 3 days by panel of 6 judges following 9 points hedonic scale. The evaluation showed that the treatment of wax emulsion coating scores highest marks (8.5) and superior in overall quality as compared to other treatments.
- 8) The papaya stored at refrigerated temperature showed chilling injury on 8th day of storage with wax emulsion coating treatments and on 4th day for the control.
- 9) The papaya stored at cold storage temperature showed chilling injury on 38th day of storage with wax emulsion coating treatments and on 20th day for the control.
- 10)The most promising treatment was the use of wax emulsion coating and intact film wrap which extended the shelf life by about 5 days and 4 days respectively.
- 11)As per organoleptic evaluation, the papaya stored at refrigerated storage with all treatments were not acceptable .The papaya stored at cold storage temperature with wax emulsion and intact film wrap were acceptable.

These findings seem to have potential, commercial application on account of their success in extending the shelf life, delaying ripening process, cost effectiveness and simple methodology without much variation in control. The fruits can be treated after harvesting at farm level itself and also it does not require special storage during transportation and marketing.

Among all the treatments, the use of wax emulsion coating treatment was found to be the best as compared to the control and other treatments followed by intact film wrap.

5.3 Processing of papaya

The experiment was carried out to study physico-chemical properties of papaya at 3 different stages i.e. 140 days, 150 days and 170 days fruit after anthesis. The results obtained are summarized below.

- 1) Fruit weight decreases as advancement of ripening occurs, at 140 days 884.6 g, at 150 days 830 g, and 170 days – 761.0 g after anthesis.
- 2) Skin colour changes from green colour with yellow spots to full yellow colour as ripening advances.
- 3) There was no significant difference in length and breadth of fruit at different stages of maturity.
- 4) Pulp per cent increases as maturity sets in, at 140 days average pulp percentage is 85.2, at 150 days 85.3 % and at 170 days 90.5 %.

- 5) Peel per cent decreases as days of ripening increases, at 140 days 11.5%, at 150 days 11.2 % and at 170 days 9.2%.
- 6) Pulp-peel ratio increases with advancement of ripening, at 140 days 7.4 %, at 150 days 7.6 %, and 170 days 9.8 %.
- 7) Pulp colour changes from pink to full yellow colour, as the day of ripening increases.
- 8) There is slight increase in protein content from 0.40 to 0.52 g/100 g and then decline from 0.52 to 0.42 g/100 g as maturity increases. Slight increase in fat, total ash and minerals as ripening advance.
- 9) Significant increase in moisture content, carbohydrates and pH value of papaya variety Taiwan-786 with the advancement of ripening. Moisture content increased from 84.5 % at 140 days fruit after anthesis to 90.8 % at 170 days fruit after anthesis. Carbohydrate increased from 6.5 g/100 g at 140 days fruit after anthesis to 9.59 g/100 g, at 170 days fruit after anthesis. Similarly pH increased from 4.0 at 140 days after anthesis to 5.2 at 170 days fruit after anthesis.
- 10) Hardness (textural property) decreases as ripening advances. Hardness decreases from 12.56 kg at 140 days fruit to 10.2 kg at 170 days fruit after anthesis.
- 11) The jam prepared from 170 days fruit after anthesis account for better quality of jam.

12) The papaya leather with sugar 5.0 percent and KMS 0.6 percent shows better acceptability.

Recommendations

1. The fruits should be harvested after 140-150 days after anthesis for better shelf life and quality.
2. The fruits should be treated with wax emulsion preferably or wrapped by intact film for extended storage life.
3. The refrigeration at 0-4⁰C produces chilling injury and hence the fruits should not be stored in commercial refrigerators.
4. The shelf life of papaya can be extended upto 20 days if it is stored in cold storage at 8⁰C and 85-90% RH with or without treatment.
5. The papaya fruits can be processed into jam and leather of acceptable quality when harvested at 170 days after anthesis i.e. 3rd stage of maturity.