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Studies on storage of bar prepared from organically grown papaya cv. ARKA Prabhat

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Abstract

An experiment was conducted to study the quality and shelf life of bar prepared from organically grown papaya cv. Arka Prabhat. The maximum TSS was observed in the papaya bar prepared from fruits of plants applied with (M₄) sheep manure 100% RDN (70.26°Brix) and (M₇) FYM 50% RDN + sheep manure 50% RDN during storage. The maximum titratable acidity was observed in papaya bar prepared from fruits of plants applied with (M₅) FYM 50% RDN + vermicompost 50% RDN (0.46%). The maximum moisture content (13.54%) was observed in papaya bar prepared from fruits of plants applied with (M₈) 100% RDN. The microbial spoilage was not observed upto 75 days of storage in all the treatments. The bar prepared from fruits of plants applied with (M₁) FYM 100% RDN and (M₄) sheep manure 100% RDN recorded minimum spoilage at 90 days after storage. The maximum shelf life 84.33 days was recorded in papaya bar prepared from fruits of plants applied with (M₁) FYM 100% RDN.

Keywords: Papaya, bar, TSS, moisture content and storage

Introduction

Papaya (*Carica papaya* L.) belongs to the family Caricaceae is one of the important fruit crops of tropical and subtropical regions of the world. Papaya fruit is rapidly becoming an important commodity worldwide, both as fresh fruit and as processed product [1]. It is a cheap source of vitamins (A, C and E) and minerals (Mg and K). Unripe fruit is a rich source of papain a proteolytic enzyme, which is very helpful in digestion of protein, used as meat tenderizer and also used for medicinal and industrial purposes. The mature fruits being utilized in the preparation of candy and tutti fruity. Ripe fruits are also used in the preparation of ready-to-serve papaya juice, jam and for table purpose.

Various products such as canned fruits, frozen slices, beverages, fruit leather, fruit bar, fruit jam are developed from fruits for value addition which are inherently perishable in nature. The ripe fruits exhibit lesser shelflife. Hence, processing of these fruits into value added products with increased shelf life is important. There is a need to reduce the post-harvest losses and improve the availability through the recommended pre and post-harvest treatments and storage to improve the marketing efficiency in papaya.

Materials & Methods

The present investigation was conducted in the College farm and Department of Fruit Science at College of Horticulture, Venkataramannagudem, Andhra Pradesh during the year 2014-15. The design for the experiment was Factorial Completely Randomized Block Design (RBD) having 8 treatments replicated thrice. Treatments were randomly allocated in each replication. The seeds of papaya cv. Arka Prabhat hybrid were procured from Indian Institute of Horticultural Research, Bangalore. The treatments were comprised of M₁ - FYM 100% RDN, M₂ - Vermicompost 100% RDN, M₃ - Neem cake 100% RDN, M₄ - Sheep manure 100% RDN, M₅ - FYM 50% RDN + Vermicompost 50% RDN, M₆ - FYM 50% RDN + Neem cake 50% RDN, M₇ - FYM 50% RDN + Sheep manure 50% RDN and M₈ - 100% RDF. The ripe papaya fruits were selected for preparation of papaya bar. The fruits were washed with clean water and peeled with a peeler. The fruits were cut longitudinally and the seeds were removed. The pulp was homogenised in a mixer and added sugar at the rate of 25 g per 100g of pulp and 0.2 per cent citric acid was added to the pulp and to which 0.2% potassium meta bisulphite was also added and blended again for two minutes.

The stainless steel trays were taken and smeared with cooking oil to prevent the bar from sticking to the tray. The prepared pulp was spread on the trays at 2mm thickness. The trays were kept in solar dryer for about 12 hours until both sides were non sticky and dried well. The same procedure was repeated for 5-6 times over the first layer and prepared the bar of desired uniform thickness and quality. The drying was continued later on to obtain desirable moisture content of 10-15% in the product. The dried bar was cut into rectangular pieces and packed in polyethylene pouches of 100 gauge and kept under ambient condition.

The total soluble solids was determined by using ERMA hand refractometer by placing a drop of filtered juice on the prism of the refractometer. The titratable acidity was calculated as per the procedure laid out by and expressed in percentage [2]

The fruit moisture content was estimated by using infrared moisture balance. It works based on weight of the sample and drying the sample by evaporating moisture, with heating system of infrared bulb. A thermometer was provided for sensing temperature and heat control is provided to adjust the bulb heat.

Plug the balance socket in A.C mains, put on the toggle switches, rotated the control nob in clockwise direction. Heated for some time to evaporate the moisture in pan and then off the infrared bulb. Then rotated the right hand knob (A) and brought the needle (pointer) and the scale to coincide with the per cent symbol. If the needle is not coincided, then rotate the left hand knob (B) to bring the pointer for coincidence. Lift the window of oven and brought the scale to zero position by rotating right hand knob. Placed the sample of about 5 to 7 g which are to be tested in the pan so that the pointer gets projected to zero. Now shut the window and switch on the bulb again and heated at 120 °C for 10-15 minutes. The needle gets lifted upward. Then rotate the right hand knob (A) to brought the needle and the scale to coincide. The reading on scale gives the percentage of the sample moisture.

Microbiological examination of the product

The yeast and mould populations in different sample products were estimated by using dilution plate method [3]. One gram of test sample was taken and thoroughly mixed in nine milliliter of sterile saline water. One milliliter of sample was transferred through a sterile pipette to a screw cap test tube containing nine milliliter of sterile saline water. This gave dilution of 10⁻¹. Similarly serial dilutions were made upto 10⁻¹⁰. One millilitre of serially diluted sample was placed in sterile petri-dish to which 5ml of potato dextrose agar medium was added and mixed thoroughly with the suspension and then allowed to set and then incubated at 30 °C for 48 hours. Individual colonies were counted and multiplied with the dilution factor to get the microbial population in one gram of sample. Yeast is the fungi which are non-filamentous but unicellular and moulds are fuzzy or cottony in appearance which commonly appears as white but may be coloured or dark or smoky.

$$\text{cfu/ml} = \frac{(\text{No. of colonies} \times \text{sample weight})}{(\text{Milliliter plated} \times \text{dilution factor})}$$

Result & Discussion

Total soluble solids (°Brix)

The data pertaining to total soluble solids of papaya bar revealed significant differences between the product prepared

from the fruits of plants was affected by application of different organic manures and days of storage (table 1).

The maximum TSS of 70.26 °Brix was recorded in the papaya bar prepared from fruits of plants applied with (M₄) Sheep manure 100% RDN and (M₇) FYM 50% RDN + neem cake 50% RDN which was on par with (M₈)100% RDF (70.07 °Brix) and (M₃) neem cake 100% RDN (69.96 °Brix) and minimum of 68.11 °Brix in (M₅) FYM 50% RDN + vermicompost 50% RDN. The highest TSS of 71.02 °Brix was recorded on 90th day of storage and minimum of 68.10 °Brix was recorded on 1st day of storage.

The TSS is an important chemical constituent which indicates the sugar content in the product and is considered as one of the important criteria for dessert quality of product. There was a gradual increase in TSS throughout the storage period irrespective of the product. This increase in the TSS might be due to loss of moisture during storage resulted in the concentration of the product [4]. An increase in total soluble solids of bar during storage might be due to hydrolysis of polysaccharide like starch, cellulose and pectin. Similar trend of increase in TSS during storage has been recorded in protein enriched mango-papaya blended bar [5] and in mixed fruit leather [6] and in guava leather [6].

Titration acidity (%)

The data pertaining to titration acidity of papaya bar (table 1) showed significant differences between the product prepared from the fruits of plants as affected by different organic manures and days of storage.

The maximum titration acidity of 0.46% was recorded in papaya bar prepared from fruits of plants applied with (M₅) FYM 50% RDN + vermicompost 50% RDN followed by fruits of plants applied with (M₈) 100% RDF (0.43%), (M₄) sheep manure 100% RDN (0.42%) and minimum of 0.38% in (M₆) FYM 50% RDN + neem cake 50% RDN. The highest titration acidity of 0.50% was recorded on 90th day of storage followed by 75th day of storage (0.47%) and minimum of 0.32% was recorded on 1st day of storage.

The results revealed that, there was a gradual increase in titration acidity of papaya bar throughout the storage period irrespective of the treatment. The significant increase in titration acidity in the fruit bar can be attributed to loss of moisture resulted in the concentration of the product during storage. Similar increase in acidity of fruit bar was report in in guava [8,9] and jackfruit bar [10] and in sapota-papaya bar [11].

Moisture content (%)

The data on moisture content of papaya bar revealed significant differences between the product prepared from the fruits of plants was affected by different organic manures and days of storage (table 2).

The maximum moisture content of 13.54% was recorded in papaya bar prepared from fruits of plants applied with (M₈) 100% RDF followed by (M₁) FYM 100% RDN (12.41%) and (M₂) vermicompost 100% RDN (11.98%) where as minimum of 11.50% in (M₅) FYM 50% RDN + vermicompost 50% RDN. The highest moisture content of 13.34% was recorded on 1st day of storage which was on par with 15th day of storage (13.06%) and minimum of 10.73% on 90th day of storage. The interactions were found to be non significant.

The loss in moisture content in bar during storage might be due to loss of residual moisture from the surface by the evaporation. In the present investigation decrease in moisture content of papaya bar was also reported earlier in sapota-papaya bar [11].

Spoilage (cfu)

The microbial changes noted in stored samples were presented in table 2. From the data it was evident that microbial load was not observed upto 75 days of storage which appeared thereafter during storage.

The minimum microbial count of 1×10^2 cfu was recorded in bar prepared from fruits of plants applied with (M₁) FYM 100% RDN and (M₄) sheep manure 100% RDN and maximum of 2×10^4 cfu was recorded in (M₃) neem cake 100% RDN and (M₈) 100% RDF on 90th day of storage. The microbial count on papaya bar was minimum initially due to addition of sugar, citric acid and removal of moisture might have aided in the storability of the bar. However, the microbial count was under permissible limit. Similar observations were reported earlier in sapota-papaya bar^[11] and in jackfruit bar^[10]. Similar results of microbial count was reported in Durian^[12] and Pear^[13]. During initial days of storage, microbial count was low and increased slightly as the

storage advances but it was well within the safe range even at three months of storage was observed in papaya^[14].

Shelf life (days)

The data pertaining to shelf life of papaya bar was presented in table 3 and revealed significant difference between the bar prepared from the fruits of plants as affected by different organic manures.

The maximum shelf life of 84.33 days was recorded in papaya bar prepared from fruits of plants applied with (M₁) FYM 100% RDN followed by (M₄) sheep manure 100% RDN (82.50 days), (M₂) vermicompost 100% RDN (82.00 days) and (M₅) FYM 50% RDN + vermicompost 50% RDN (82.00 days) where as minimum of 73.20 days was recorded in (M₆) FYM 50% RDN + neem cake 50% RDN. The addition of sugar, citric acid, potassium meta bisulphite and removal of moisture might have aided in the storability of the bar. Similar observations were recorded in guava leather^[15, 16].

Table 1: Effect of organic manures on total soluble solids (°Brix) and titrable acidity (%) of papaya (*Carica papaya* L.) bar during storage under ambient condition

Treatments	Number of days of storage															
	Total soluble solids (°Brix)								Titrable acidity (%)							
	1	15	30	45	60	75	90	Mean	1	15	30	45	60	75	90	Mean
M ₁	67.25	67.82	67.93	68.56	69.63	69.94	70.57	68.81	0.29	0.31	0.35	0.41	0.43	0.46	0.48	0.39
M ₂	68.20	68.44	69.00	69.73	70.50	70.74	71.21	69.69	0.31	0.33	0.37	0.41	0.44	0.46	0.49	0.40
M ₃	68.25	68.78	69.66	70.36	70.67	70.94	71.05	69.96	0.33	0.37	0.41	0.43	0.46	0.48	0.49	0.42
M ₄	69.10	69.32	69.96	70.41	70.76	70.99	71.33	70.26	0.3	0.58	0.39	0.43	0.46	0.48	0.50	0.42
M ₅	66.55	66.88	67.61	68.25	68.67	69.19	69.68	68.11	0.35	0.38	0.42	0.47	0.51	0.55	0.59	0.46
M ₆	68.25	68.29	68.89	69.12	70.05	70.64	71.26	69.50	0.26	0.30	0.35	0.39	0.42	0.46	0.48	0.38
M ₇	69.10	69.33	69.78	70.18	70.68	71.00	71.73	70.26	0.30	0.33	0.37	0.41	0.44	0.47	0.50	0.40
M ₈	68.10	68.76	69.81	70.50	70.72	71.33	71.32	70.07	0.34	0.36	0.41	0.44	0.48	0.49	0.51	0.43
Mean	68.10	68.45	69.08	69.64	70.21	70.59	71.02		0.32	0.37	0.38	0.42	0.45	0.47	0.50	

Factor	Total soluble solids (°Brix)			Titrable acidity (%)		
	M	D	M*D	M	D	M*D
S. Em±	0.15	0.14	0.40	0.01	0.08	0.02
C.D (0.05)	0.42	0.40	N.S	0.02	0.02	N.S

M ₁ - FYM 100% RDN	M ₅ - FYM 50% RDN + Vermicompost 50% RDN	M- Manures
M ₂ - Vermicompost 100% RDN	M ₆ - FYM 50% RDN + Neem cake 50% RDN	D- Days of storage
M ₃ - Neem cake 100% RDN	M ₇ - FYM 50% RDN + Sheep manure 50% RDN	RDN- Recommended dose of Nitrogen
M ₄ - Sheep manure 100% RDN	M ₈ - 100% RDF	RDF- Recommended dose of fertilizer

Table 2: Effect of organic manures on moisture content (%) and spoilage (Cfu) of papaya (*Carica papaya* L.) bar during storage under ambient condition

Treatments	Number of days of storage															
	Moisture content (%)								Spoilage (cfu)							
	1	15	30	45	60	75	90	Mean	1	15	30	45	60	75	90	
M ₁	14.10	13.67	12.53	12.04	11.67	11.52	11.35	12.41	0	0	0	0	0	0	1 × 10 ²	
M ₂	13.25	13.10	12.24	12.07	11.45	11.01	10.74	11.98	0	0	0	0	0	0	1 × 10 ⁴	
M ₃	13.20	12.90	12.00	11.30	11.11	10.81	10.50	11.69	0	0	0	0	0	0	2 × 10 ⁴	
M ₄	12.90	12.64	12.06	11.66	10.96	10.58	10.27	11.58	0	0	0	0	0	0	1 × 10 ²	
M ₅	12.45	12.17	11.93	11.38	11.21	10.91	10.50	11.50	0	0	0	0	0	0	1 × 10 ⁴	
M ₆	13.30	12.91	12.14	11.44	11.14	10.66	10.51	11.73	0	0	0	0	0	0	1 × 10 ⁴	
M ₇	12.45	12.16	11.96	11.56	11.16	10.83	10.50	11.51	0	0	0	0	0	0	1 × 10 ⁴	
M ₈	15.10	14.99	14.38	13.73	12.75	12.33	11.50	13.54	0	0	0	0	0	0	2 × 10 ⁴	
Mean	13.34	13.06	12.40	11.89	11.43	11.08	10.73									

Factor	Moisture content (%)		
	M	D	M*D
S.Em±	0.13	0.12	0.34
C.D (0.05)	0.36	0.34	N.S

M ₁ - FYM 100% RDN	M ₅ - FYM 50% RDN + Vermicompost 50% RDN	M- Manures, cfu- colony forming unit
M ₂ - Vermicompost 100% RDN	M ₆ - FYM 50% RDN + Neem cake 50% RDN	D- Days of storage
M ₃ - Neem cake 100% RDN	M ₇ - FYM 50% RDN + Sheep manure 50% RDN	RDN- Recommended dose of Nitrogen
M ₄ - Sheep manure 100% RDN	M ₈ - 100% RDF	RDF- Recommended dose of fertilizer

Table 3: Effect of organic manures on shelf life (days) of papaya (*Carica papaya* L.) bar during storage under ambient condition

Treatments	Shelf life (days)
M ₁ -FYM 100% RDN	84.33
M ₂ -Vermicompost 100% RDN	82.00
M ₃ -Neem cake 100% RDN	80.00
M ₄ -Sheep manure 100% RDN	82.50
M ₅ -FYM 50%RDN + Vermicompost 50% RDN	82.00
M ₆ -FYM 50%RDN + Neem cake 50% RDN	73.20
M ₇ -FYM 50%RDN + Sheep manure 50% RDN	81.33
M ₈ - 100% RDF	79.50
S. Em±	0.31
C.D (0.05)	1.03

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