HortFlora Research Spectrum, 1(4): 318-322 (2012) ISSN : 2250-2823

QUALITATIVE EFFECT OF WRAPPING AND CUSHIONING MATERIALS ON GUAVA FRUITS DURING STORAGE

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ABSTRACT : The aim of the present study was to investigate the effect of wrapping and cushioning materials on guava (*Psidium guajava* L.) fruits during storage. Fruits were packed in different wrapping and cushioning materials viz. Tissue paper, Cling wrap, Banana leaves and Teak leaves as wrapping materials, Neem leaves, Rice straw and Bamboo leaves as cushioning materials and control. All the treatments were kept at controlled room temperature (25±2°C), relative humidity (85±5%) in corrugated fibre board (CFB) boxes. The effectiveness of the treatments was assessed in terms of its impact on fruit appearance, weight loss, total soluble solids (TSS), titratable acidity, ascorbic acid contents and total sugars. It was found that wrapping of fruits with cling wrap showed better result for most of the parameters rating followed by wrapping with teak leaves. In organoleptic ratings fruits wrapped in teak leaves showed better result while poor rating was recorded in cling wraps.

Keywords: *Cushioning, guava, organoleptic, quality wrapping, storage.*

Guava (*Psidium guajava* L.) is one of the most important fruit crops of tropical and sub-tropical regions of India. It is one of the commonest fruits liked by poor and the rich people.

The whole fruit is edible along with skin. Due to high calorific value guava fruits have achieved fame as "Poor man's Apple" in India (Singh, 10). Guava tree are very hardy, long lived/ prolific bearer and need comparatively less attention which makes its cultivation more remunerative (Tyagi and Patel, 12). India has great potential to produce high quality guava fruits and to export them to other countries however its marketability is still limited to local market. This is due to the delicate nature of fruit, poor handling practices and inadequate storage facilities. Therefore, proper handling technique and control of the ripening process are crucial for the better shelf life of guava fruits. Use of proper packaging material is a vital component of post harvest management. The efficiency of different wrapping and cushioning materials varies from fruit to fruit. Therefore, selection of suitable packaging material is of prime importance for better shelf life of fruits. The present investigation was carried out on winter guava fruits to study the effect of various wrapping and cushioning materials on shelf life of guava.

Received : 23.7.2012 *Accepted : 18.8.2012*

MATERIALS AND METHODS

Present studies were carried out in Post Graduate Laboratory of Department of Horticulture, Gobind Ballabh Pant University of Agriculture and Technology, Pantnagar during October and November 2010. Fully mature fruits of guava cv. Pant Prabhat at green colour were harvested. These fruits were packed in corrugated fibre board boxes (CFB). Fruits were wrapped in tissue paper, cling wrap, banana leaves and teak leaves. Cushioning was done by keeping the cushioning materials between the two rows of fruits inside the CFB boxes. Neem leaves, rice straw and bamboo leaves were used as cushioning materials (Fig. 1). Observations for all the parameters were recorded after 4^{th} and 7^{th} day of storage. Per cent loss in weight was determined by calculating difference between initials weight and weight after storage and this value is changed into percentage. TSS was recorded with the help of hand refrectometer at room temperature. Acidity and ascorbic acid were determined by titrametric methods as described by A.O.A.C. (1) and Ranganna (7). Total sugar and pectin content were

determined by method as described by Rangana (1986). TSS: acids ratio was calculated by dividing T.S.S. by acid per cent. Organoleptic rating was done by a panel of four judges taking into consideration texture, appearance and taste. The data was analysed statistically using completely randomised design (CRD) and critical difference (C.D.) was calculated at 5 per cent. The per cent data were transformed angularly whenever seemed fit.

RESULTS AND DISCUSSION

Per cent loss in weight (PLW) increased with increasing period of storage in all the treatments. Fruits wrapped in cling wrap showed minimum PLW whereas untreated fruits showed maximum PLW after seven days of storage. Likewise it was minimum when rice straw was used as cushioning material (Fig. 1). The loss in fruit weight might be due to the fact that wrapping materials are known to retard the rate of respiration, transpiration and maintaining fruit firmness. These results are in close conformity with the finding of Baviskar *et al*. (3) as they reported maximum per cent loss in fruit weight from control fruits while polythene packed fruits showed minimum loss in weight of guava fruits. Present finding revealed that the edible quality of guava fruits was decreasing with increasing storage period. Pectin retention was also higher in cling wrap after 7 days of storage when neem leaves were used as cushioning material (Fig. 2). The reduction in pectin content during storage might be due to degradation of insoluble protopectin by the enzymes such as pectin methyl esterase (PME) enzyme and activity of enzyme increased as ripening advanced in guava. These findings are in accordance with the results of Chaitanya (4) in guava as he reported minimum retention of pectin from unwrapped fruits.

There was significant effect of wrapping and cushioning on TSS (Table 1). Fruit wrapped in cling wrap showed the reduced rate of increase in TSS. This might be mainly due to slow conversion of starch into sugars. Maximum increase in TSS was observed in cushioning of fruits with Neem leaves followed by wrapping of fruits with Teak leaves. It might be due to quick conversion of starch into sugar. TSS content of guava fruits increased initially up to 4th day of storage and decreased` thereafter. Increase in total soluble solids during storage may be due to the breakdown of complex polymers into simple substances by hydrolytic enzymes which might be further metabolized during respiration and thus the level got decreased during subsequent storage. Sharma *et al.* (8) also found similar results as they reported that newspaper packed fruits of guava cv. Sardar recorded the maximum increase in TSS. Wrapping and cushioning materials had no significant effect on acidity (Table 1). Acidity of the fruits decreased continuously in storage at room temperature. Maximum acidity was found when fruits were harvested. These findings are in close conformity with Agarwal *et al.* (2) as they reported that titratable acidity decreased with advancing maturity. The decrease in acidity during storage might be due to conversion of acids into salts and sugars by the enzymes particularly invertase.

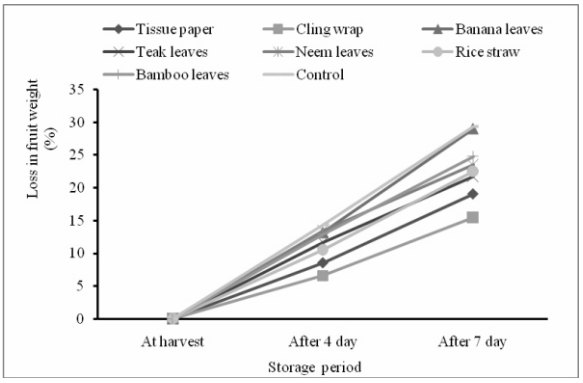

Fig. 1: Effect of wrapping and cushioning material on loss in fruit weight.

Total sugars content of guava fruit increased with high rate up to 4th day of storage and then rate was decreased thereafter (Table 2). The increase in total sugar during storage might be because of an increase in reducing sugars and non-reducing sugars resulting conversion of starch into simple

Table 1: Effect of different wrapping and cushioning materials on TSS and acidity in stored guava.

Treatment	TSS			Acidity (%)		
	At harvest	After 4 days	After 7 days	At harvest	After 4 days	After 7 days
Wrapping material						
Tissue paper	10.66	12.80	12.80	0.210 (2.521)	0.093 (1.740)	0.018 (1.870)
Cling wrap	10.20	11.16	12.20	0.180 (2.460)	0.130 (2.120)	0.114 (1.932)
Banana leaves	13.27	13.26	12.13	0.150 (2.192)	0.091 (1.720)	0.087 (1.660)
Teak leaves	10.63	12,30	13.26	0.210 (2.530)	0.125 (2.011)	0.104 (1.844)
Cushioning material						
Neem leaves	13.13	12.93	14.53	0.180 (2.454)	0.102 (1.820)	0.102 (1.820)
Rice straw	12.93	13.50	13.16	0.190 (2.563)	0.098 (1.772)	0.101 (1.832)
Bamboo leaves	12.26	14.00	13.27	0.170 (2.250)	0.117 (1.950)	0.093 (1.730)
Control	12.67	13.80	12.13	0.150 (2.233)	0.082 (1.640)	0.075 (1.550)
C.D. (P=0.05)	1.79	0.41	0.82	NS	NS	NS

Note: Values in parentheses are angularly transformed.

Table 2: Effect of different wrapping and cushioning materials on total sugar and TSS: acid ratio.

Treatment	Total Sugar			TSS/Acid ratio		
	At harvest	After 4 days	After 7 days	At harvest	After 4 days	After 7 days
Wrapping material						
Tissue paper	6.42 (14.67)	10.23 (18.56)	12.51 (20.71)	55.61	135.09	116.80
Cling wrap	6.23 (14.66)	12.27 (20.56)	12.65 (20.83)	55.32	91.32	100.78
Banana leaves	6.02 (14.21)	13.39 (21.46)	13.41 (21.48)	91.62	148.05	146.66
Teak leaves	5.90 (14.06)	12.40 (20.62)	13.40 (21.47)	54.94	110.82	117.98
Cushioning material						
Neem leaves	6.56 (14.89)	12.70 (20.88)	12.91 (21.07)	70.89	130.96	127.72
Rice straw	6.03 (14.22)	12.77 (20.94)	13.25 (21.34)	65.04	150.61	115.07
Bamboo leaves	6.17 (14.39)	12.69 (20.85)	13.70 (21.75)	80.63	120.19	131.79
Control	6.97 (15.31)	14.03 (22.00)	14.67 (22.52)	84.08	169.05	159.03
C.D. (P=0.05)	0.18	0.76	1.00	NS	NS	NS

Note: Values in parentheses are angularly transformed.

Table 3: Effect of different wrapping and cushioning materials on ascorbic acid and organoleptic rating.

Treatment	Ascorbic Acid			Organoleptic rating		
	At harvest	After 4 days	After 7 days	At harvest	After 4 days	After 7 days
Wrapping material						
Tissue paper	159.48	48.34	27.75	7.20	6.25	4.70
Cling wrap	164.88	81.05	49.83	7.13	5.84	4.20
Banana leaves	147.24	40.45	23.64	6.95	6.06	4.29
Teak leaves	168.12	45.38	29.04	7.05	6.78	4.45
Cushioning material						
Neem leaves	169.20	36.01	19.46	6.75	6.25	4.04
Rice straw	177.84	38.98	21.39	6.61	5.83	3.49
Bamboo leaves	147.29	45.88	27.15	6.92	5.80	3.67
Control	172.26	27.15	18.04	7.52	6.20	3.69
C.D.(P=0.05)	15.18	15.12	13.06	0.51	0.99	0.37

sugar and later on reduction in rate was due to utilization of sugar in the process of respiration. These results are in close conformity with the findings of Parihar and Kumar (6) as they reported that total sugars were increased with the increase of storage period in guava. TSS: acid ratio was increased in fruit during storage (Table 2). It might be due to the fact that increase in TSS was there during storage while acidity decreased (Agarwal *et al.,* 2).

Fruits wrapped in cling wrap retained higher content of ascorbic acid during storage after seven days of storage likewise when bamboo leaves used as cushioning material showed maximum retention

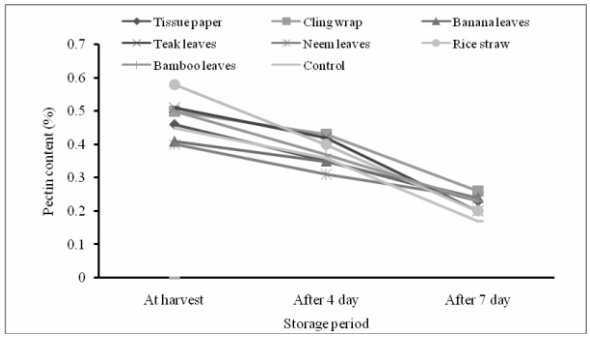

Fig. 2: Effect of wrapping and cushioning material on pectin content.

of ascorbic acid (Table 3). Cling wrap probably retard several ripening processes and hence the rate of conversion of L-ascorbic acid into dehydro ascorbic acid is slowed down. The loss in ascorbic acid content of fruit during prolonged storage is mainly due to oxidation of L-ascorbic acid into dehydro ascorbic acid by the enzyme ascorbinase. Gupta and Jawandha (5) and Srivastava *et al.* (11) also found decreasing trend of ascorbic acid during storage of peach and guava fruits, respectively. The organoleptic quality was better in wrapped fruits as compare to unwrapped control fruits except cling wrapped fruits which showed poor organoleptic rating during storage (Table 3). Similar results were also recorded by Siddiqui and Gupta (9) as they reported that the organoleptic quality was better in wrapped guava fruits as compare to unwrapped control fruits except polythene wrapped fruits which showed poor organoleptic rating throughout the storage.

On the basis of above results, it can be concluded that for most of parameters cling wrap showed good results closely followed by Teak leaf wrapping. Fruits wrapped in banana leaves showed growth of fungus in some fruits. Effect of different cushioning materials on physical and chemical parameters are satisfactory up to some extent.

Fruits without wrapping and cushioning (control) had poor physical and chemical properties. In organoleptic ratings fruits wrapped in Teak leaves showed best results while poor rating was recorded in Cling wrapping.

In overall cling wrap was considered as a good wrapping material for guava fruits followed by wrapping with Teak leaves. Among the naturally available materials Teak leaves showed best results.

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