

<http://www.pjbs.org>

**PJBS**

ISSN 1028-8880

**Pakistan  
Journal of Biological Sciences**

**ANSI***net*

Asian Network for Scientific Information  
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

## Shelf Life of Ten Guava Varieties under Different Post Harvest Treatments in on Season

<sup>1</sup>Shamim Ara Begum, <sup>2</sup>M.A. Rahim, <sup>3</sup>M.A. Haider and <sup>2</sup>M.A. Kader

<sup>1</sup>Bangladesh Agricultural Research Institute, <sup>3</sup>Fruit Tree Improvement Project,

<sup>2</sup>Bangladesh Agricultural University, Mymensingh 2202, Bangladesh

**Abstract:** The experiment was carried out to study the shelf life of guava under different post harvest treatments. Qualities of fruits of different varieties decreased with the advancement of storage duration and most were found to lose their marketability at the later stage except Kazi and Swarupkathi. In case of wrapping materials, white and black perforated polythene bags were better in on season for retaining marketability of guava fruits as compared with other treatments. Considering combined effect of variety and wrapping materials, fruits of the Kazi showed the longer duration of marketability among 10 varieties with all treatments. Weight loss of different guava varieties increased with increasing storage duration. Variety Kazi showed the lowest percentage of weight loss. In case of wrapping materials, black and white perforated polythene bags gave minimum weight loss. Based on combined effect of variety and wrapping materials, the variety Kazi showed minimum weight loss among 10 varieties in all wrapping treatments.

**Key words:** Guava variety, post harvest, shelf life, wrapping materials, on season

### Introduction

Guava is a very common fruit in Bangladesh. It is popular among the rich and poor people due to its comparatively low price than some other fruits, nourishing value and good taste. It is a rich and cheap source of vit. C (560 mg/100 g) (Phandis, 1970) which is the second after aonla (600 mg/100 g) and 2 to 5 times higher than fresh orange juice. It is a fair source of vit. A and good source of calcium and phosphorus. It also contains much iron. It is also rich in pectin, which has industrial use for jelly production (Bose and Mitra, 1990). Guava fruits relished when mature on ripe and freshly plucked from the tree. Fresh and matured guava is taken by chewing. Salad and pudding are prepared from shell of the ripe fruit. Excellent processed materials, jam, jelly, cheese, ketchup, puree, juice, powder, nectar etc. are prepared commercially from ripe guava. It is also used for canned slices. Most fruits used for canning are considered best when they are firm-ripe, full size and full of flavour, but are not ripe enough. Rodriguez *et al.* (1975) found that fully ripe guava fruits give more acceptable processed and canned product than firm-ripe fruit. In some countries the leaves are used for curing diarrhoea and also for dyeing and tanning. Bangladesh is a densely populated country with a population growth rate of 1.6% per annum in recent years. Comparing population growth rate production is not increasing. So the need for maintaining the population-food-nutrition balance can hardly be overemphasized. Most of the people of Bangladesh suffer from malnutrition specially vitamins and minerals. Guava is a good source of readily up-takeable vitamin and minerals. It is also very cheap and easily available. It is quite hairy, prolific bearer and highly remunerative even without much cares (Bose and Mitra, 1990). It can specially be grown in homestead areas throughout the country even without or little care. But in some regions such as Barisal, Sylhet and Chittagong it is cultivated commercially. Changes in the physico-chemical properties occur during different stages of ripening and storage. The world is currently producing about five billion metric tons of food for the hungry teeming millions. A considerable proportion (30 to 40%) of the produce in the developing countries never reaches the consumer, mainly because of pre and post-harvest loss (Millar, 1976). As estimated by Lashley (1984) an approximately 30-50% fruit goes waste during post-harvest handling, storage and ripening. This post-harvest loss is highly prominent in guava because of its high perishability. Once it is fully ripe, the fruit becomes soggy, edible and marketing quality deteriorates rapidly. The perishability of fruit is attributed to adverse physiological changes, namely, loss of weight due to respiration and transpiration, softening of flesh and loss of resistance to microbial attack. Fruits having soggy characteristics are subjected to more damage during shipment. No

reliable statistical data are available especially in Bangladesh to indicate magnitude of post-harvest loss of guava. Therefore, a critical area of examination would be how to reduce these post-harvest losses in guava and other fresh fruits and to make a better situation of population-food balance in Bangladesh. Under the above circumstances, storage life of 10 guava varieties have been included in present study to evaluate the effects of different post harvest treatments on the shelf life of guava.

### Materials and Methods

The experimental materials were mature fruits of 10 guava varieties which were collected from the Fruit Tree Improvement Project (FTIP) at the Horticulture farm of Bangladesh Agricultural University, Mymensingh during the period from July to September 1999. Three plants of each variety were selected randomly representing 3 replications. Two-factor experiment was conducted in randomized complete block design (RCBD). In this experiment two factors were considered: Factor A: ten varieties of guava viz., Swarupkathi, Jelly, IPSA, Allahabad, Apple, L-49, Kazi, Madhuri, Poly and Mukundapuri and Factor B: Post-harvest treatments viz., T<sub>1</sub> = control (no wrapping), T<sub>2</sub> = white non-perforated polythene bag (WNP), T<sub>3</sub> = white perforated polythene bag (WP), T<sub>4</sub> = black non-perforated polythene bag (BNP) and T<sub>5</sub> = black perforated polythene bag (BP). Twenty-five fruits of uniform maturity from each plant were randomly collected during peak fruiting season in July to August, 1999 (on season). All harvested fruits of each tree were then divided into five groups for five treatments, each representing the individual treatment. Data for percent weight loss and percent marketable fruit during storage were collected at 2 days interval. Weight loss was determined by calculating the weight of fruits by an electric balance at 2 days interval after storing, up to rotting. Percentage of marketable fruit was determined by eye estimation and finger-feeling method, thus shelf life of fruits was determined. The recorded data on different parameters of the study was analyzed statistically using MSTAT computer package programme. Analysis of variance of different parameters was performed by 'F' test. The mean differences were performed by LSD test (Gomez and Gomez, 1984).

### Results and Discussion

#### Percent marketable guava fruits at different storage duration

**Main effect of variety:** Percentage of marketable fruits of different varieties showed highly significant variation at each storage duration (Table 1). In general the values were decreased with increasing storage duration. The marketability of fruits of all the varieties showed decreasing pattern after 2 days of storage. The variety IPSA showed the highest percentage (96.00%) of

Begum *et al.*: Shelf life of guava varieties under different post harvest treatments

Table 1: Percent marketable fruits of different guava varieties at different storage durations

Varieties	Storage duration (days)					
	2	4	6	8	10	12
Swarupkathi	98.34	94.48	90.14	86.02	44.24	34.78
Jelly	96.02	91.79	90.27	0.00	0.00	0.00
IPSA	97.85	96.00	92.00	31.85	5.54	0.00
Allahabad	95.47	91.44	66.90	46.28	0.00	0.00
Apple	95.40	90.04	86.82	0.00	0.00	0.00
L-49	97.40	92.92	89.17	79.68	59.35	0.00
Kazi	97.67	94.82	92.96	90.27	88.79	86.87
Madhuri	98.45	94.92	92.36	89.10	30.56	0.00
Poly	95.25	89.36	88.17	0.00	0.00	0.00
Mukandapuri	97.95	94.58	87.74	78.80	50.61	0.00
LSD 5%	0.703	2.224	3.595	7.564	13.064	2.694
1%	0.943	2.984	4.824	10.148	17.528	3.614
Level of significance	**	**	**	**	**	**

Table 2: Effect of wrapping materials on percent marketable fruits of guava

Wrapping materials	Storage duration (days)					
	2	4	6	8	10	12
White non perforated polythene bag (WNP)	98.98	97.43	92.54	57.15	29.11	9.63
Black non perforated polythene bag (BNP)	98.95	97.46	91.20	56.14	30.68	9.68
White perforated polythene bag (WP)	97.39	93.97	83.14	49.44	24.10	14.23
Black perforated polythene bag (BP)	97.25	94.32	89.87	53.22	30.09	16.43
Control	92.32	81.96	69.20	35.05	25.57	10.84
LSD 5%	0.497	1.572	1.556	5.348	9.238	1.905
1%	0.667	2.110	2.089	7.176	12.394	2.556
Level of significance	**	**	**	**	**	**

NS = non significance, \* = Significant at 5% level, \*\* = Significant at 1% level

marketability at 4 days after storing followed by Madhuri (94.92%). Like wise 6 days after storing Kazi followed by Madhuri showed the higher percentage of marketable fruits (92.96 and 92.36%, respectively), at 8 days from storing. The two varieties Kazi and Madhuri also showed higher percentage of marketability and the varieties Jelly, Apple and Poly reached the non-marketable stage. At 10 days after storage, Kazi showed the higher percentage (88.79%) of marketable fruit, but only 5.54% marketable fruits were found in IPSA. At this stage fruits of variety Allahabad also lost their marketability. After 12 days from storing, Kazi (86.87%) and Swarupkathi (34.78%) remained marketable, but the fruits of the rest varieties totally lost their marketability.

**Effect of wrapping materials on percent marketable fruits of guava:** Effect of different wrapping materials on percent marketable fruits showed highly significant variation at 2, 4, 6, 8 and 12 days of storage (Table 2). Fruits in white non-perforated polythene bag (WNP) remained as in the highest (98.98%) marketable condition at 2 days of storage, whereas the lowest (92.32%) was found in control. After 4 days of storage, 97.46% fruits were marketable in black non-perforated polythene bag (BNP) followed by 97.43% (in WNP), 94.32% (in black perforated polythene bag- BP), 93.97% (in white perforated polythene bag- WP) and 81.96% (in control), whereas 89.87 and 91.20% fruits were marketable in WP and BNP after 6 days of storage, rest wrapping materials kept marketability of fruits from 69.20 to 89.87%. At 8 days of storage, 57.15 and 56.14% fruits were marketable in WNP and BNP, respectively. Marketable fruits ranged from 24.10 (in WP) to 30.68% (in BNP) followed by 30.09% (in BP) after 10 days of storage, whereas the highest percentage (16.43%) of marketability was found in BP followed by WP (14.23%) at 12 days after storage.

**Combined effect of varieties and wrapping materials:** Combined effects of varieties and wrapping materials on percent marketable fruits showed highly significant variation at 2, 6, 8, 10 and 12

days of storage (Table 3). After 2 days of storage fruits of Swarupkathi, Jelly, IPSA, Allahabad, Madhuri, Mukundapuri in WNP and Apple, L-49, Kazi and Poly in BNP showed higher percentage of marketable condition. Swarupkathi, Jelly, IPSA, Apple, L-49, Kazi and Poly fruits in BNP and Allahabad, Apple, Madhuri and Mukundapuri fruits in WNP showed higher percentage of marketability at 4 days after storage. After 6 days of storage, Swarupkathi, IPSA, Poly, Mukundapuri in WNP and Jelly, Allahabad, Apple, L-49, Kazi and Madhuri in BNP showed higher percentage of marketability. At 8 days after storage, fruits of Swarupkathi and IPSA in WNP; Apple, L-49, Kazi and Madhuri in BNP: Allahabad and Mukundapuri in BP showed higher percentage of marketability, but in case of Jelly, Apple and Poly (for all treatments) and Allahabad (in control) no fruits were found in marketable condition. At 10 days after storing, fruits of some varieties like, L-49, Kazi and Madhuri showed higher percentage of marketability in BNP and Mukundapuri in BP. In case of Swarupkathi (in BNP), IPSA (in WP and control) and Allahabad (in all treatments) no fruits were found in marketable condition. At 12 days after storing, fruits of all varieties except Swarupkathi and Kazi lost their marketability.

**Weight loss of different guava varieties at different storage duration**

**Main effect of varieties:** Weight loss of different guava varieties showed significant variation at each storage duration (Table 4). Different guava varieties showed increasing trend of weight loss with the advancement of the storage duration. The result is in close conformity with the results obtained by Dutta *et al.* (1991). At 2 days after storing, the physiological weight loss of fruits of different guava varieties ranged from 1.56 (in Madhuri) to 4.77% (in Poly). The variety IPSA showed the lowest (4.05%) weight loss at 4 days after storing, whereas Apple showed the highest (9.96%) level of weight loss at that stage. In case of 6 days after storing, the highest weight loss was recorded from the fruits of Allahabad (33.10%) followed by IPSA (32.61%) and the lowest from Kazi (7.05%). At 8 days after storing, the highest weight

Begum *et al.*: Shelf life of guava varieties under different post harvest treatments

Table 3: Combined effect of different varieties and wrapping materials on percent marketable fruits of guava

Varieties	Wrapping materials	Storage duration (days)					
		2	4	6	8	10	12
Swarupkathi	WNP	99.67	98.51	97.33	96.15	36.26	0.00
	BNP	99.66	98.64	97.12	94.59	0.00	0.00
	WP	98.62	95.67	84.19	82.18	54.02	52.95
	BP	98.18	94.81	93.47	84.59	73.79	72.00
	Control	95.60	84.77	78.60	72.60	57.11	49.00
Jelly	WNP	98.14	96.43	95.43	0.00	0.00	0.00
	BNP	98.10	96.96	96.10	0.00	0.00	0.00
	WP	96.21	93.12	91.75	0.00	0.00	0.00
	BP	96.41	93.15	91.53	0.00	0.00	0.00
	Control	91.24	79.29	76.55	0.00	0.00	0.00
IPSA	WNP	99.73	98.67	96.00	67.87	22.53	0.00
	BNP	99.62	99.37	74.81	41.52	2.66	0.00
	WP	97.05	95.22	47.47	9.69	0.00	0.00
	BP	99.44	98.73	94.23	30.00	2.53	0.00
	Control	93.38	87.79	24.43	10.18	0.00	0.00
Allahabad	WNP	98.77	96.91	59.85	59.23	0.00	0.00
	BNP	97.31	95.30	74.48	54.23	0.00	0.00
	WP	98.21	92.85	73.80	58.31	0.00	0.00
	BP	95.03	91.30	68.30	59.60	0.00	0.00
	Control	88.01	80.30	58.06	0.00	0.00	0.00
Apple	WNP	97.51	95.17	93.43	0.00	0.00	0.00
	BNP	98.00	95.17	93.71	0.00	0.00	0.00
	WP	95.65	90.70	86.79	0.00	0.00	0.00
	BP	95.52	90.91	88.21	0.00	0.00	0.00
	Control	90.34	78.26	71.94	0.00	0.00	0.00
L-49	WNP	98.87	96.92	96.11	71.85	49.33	0.00
	BNP	99.04	97.13	96.17	94.56	92.05	0.00
	WP	97.94	93.67	90.44	87.08	54.61	0.00
	BP	97.18	92.39	99.19	80.69	46.10	0.00
	Control	93.95	84.46	73.94	64.21	54.63	0.00
Kazi	WNP	99.63	98.91	98.28	97.69	96.95	96.34
	BNP	99.78	99.35	98.80	98.15	97.50	96.84
	WP	98.41	96.08	94.60	89.21	90.97	89.32
	BP	98.77	97.15	96.16	94.84	93.80	92.32
	Control	91.73	82.60	76.93	68.44	64.74	59.51
Madhuri	WNP	99.64	98.45	97.02	95.50	30.42	0.00
	BNP	99.51	98.05	97.23	95.59	62.81	0.00
	WP	98.78	95.32	93.46	90.53	11.15	0.00
	BP	98.80	95.96	93.39	89.42	19.95	0.00
	Control	95.50	86.82	80.72	74.45	28.39	0.00
Poly	WNP	98.22	95.93	94.75	0.00	0.00	0.00
	BNP	98.97	96.51	94.56	0.00	0.00	0.00
	WP	94.12	90.92	88.68	0.00	0.00	0.00
	BP	94.71	92.31	89.40	0.00	0.00	0.00
	Control	90.22	71.13	73.47	0.00	0.00	0.00
Mukundapuri	WNP	99.57	98.43	97.25	83.22	55.61	0.00
	BNP	99.55	98.13	89.00	82.76	51.73	0.00
	WP	98.93	96.16	80.18	74.37	30.25	0.00
	BP	98.44	96.15	94.86	93.05	64.68	0.00
	Control	93.24	83.61	77.39	60.58	50.79	0.00
LSD	5%	1.527	4.972	8.040	16.913	29.212	29.212
	1%	2.109	6.671	10.787	22.692	39.195	39.195
Level of significance		**	NS	**	**	**	**

Table 4: Percent weight loss of different guava varieties at different storage duration

Varieties	Storage duration (days)						
	2	4	6	8	10	12	
Swarupkathi	1.66	5.53	9.86	13.98	55.77	65.23	
Jelly	3.98	8.21	9.06	100.00	100.00	100.00	
ISPA	2.16	4.05	32.61	68.15	94.46	100.00	
Allahabad	4.53	8.56	33.10	56.39	100.00	100.00	
Apple	4.60	9.96	13.18	100.00	100.00	100.00	
L-49	2.80	7.06	10.83	20.86	40.66	93.86	
Kazi	2.33	5.20	7.05	9.73	11.21	13.13	
Madhuri	1.56	5.09	7.64	10.90	69.48	100.00	
Poly	4.77	8.64	11.83	100.00	100.00	100.00	
Mukundapuri	2.10	5.43	12.27	21.22	49.39	100.00	
Lsd	5%	0.718	1.105	3.696	7.020	13.064	6.145
	1%	0.963	1.483	4.958	9.419	70.528	4.245
Level of significance		**	**	**	**	**	**

Begum *et al.*: Shelf life of guava varieties under different post harvest treatments

Table 5: Effect of wrapping materials on weight loss of guava varieties at different storage duration

Wrapping material	Storage duration (days)					
	2	4	6	8	10	12
White non perforated polythene bag (WNP)	1.05	2.57	7.46	42.85	70.89	90.37
Black non perforated polythene bag (BNP)	1.05	2.54	8.80	45.20	69.32	87.25
White perforated polythene bag (WNP)	2.61	6.03	10.86	50.56	75.90	85.77
Black perforated polythene bag (BP)	2.85	5.66	10.13	47.11	69.91	83.57
Control	7.69	17.06	30.46	64.89	74.45	89.16
LSD 5%	0.507	0.781	2.613	4.964	9.230	4.345
1%	0.681	1.048	3.506	6.660	12.394	5.830
Level of significance	**	**	**	**	**	**

Table 6: Combined effect of different varieties and wrapping materials on weight loss of guava varieties at different storage duration

Treatments		Storage duration (days)					
Varieties	Wrapping materials	2	4	6	8	10	12
Swarupkathi	WNP	0.33	1.49	2.67	3.85	63.74	100.00
	BNP	0.34	1.36	2.89	5.41	100.00	100.00
	WP	1.38	4.33	15.81	17.82	45.98	47.05
	BP	1.82	5.19	6.53	15.41	26.21	28.00
	Control	4.40	15.25	21.40	27.39	42.89	51.07
Jelly	WNP	1.86	3.57	4.57	100.00	100.00	100.00
	BNP	1.90	3.04	3.90	100.00	100.00	100.00
	WP	3.90	6.88	8.25	100.00	100.00	100.00
	BP	3.59	6.86	8.47	100.00	100.00	100.00
	Control	8.76	20.71	20.11	100.00	100.00	100.00
IPSA	WNP	0.27	1.33	4.00	32.13	77.47	100.00
	BNP	0.38	0.63	25.19	58.48	97.34	100.00
	WP	2.95	4.78	52.53	90.31	100.00	100.00
	BP	0.57	1.27	5.77	70.00	97.47	100.00
	Control	6.62	12.21	75.57	89.82	100.00	100.00
Allahabad	WNP	1.23	3.09	40.15	40.77	100.00	100.00
	BNP	2.69	4.71	25.52	59.10	100.00	100.00
	WP	1.79	7.15	26.20	41.69	100.00	100.00
	BP	4.97	8.70	31.70	40.40	100.00	100.00
	Control	11.99	19.17	41.94	100.00	100.00	100.00
Apple	WNP	2.49	4.83	6.57	100.00	100.00	100.00
	BNP	2.00	4.84	6.29	100.00	100.00	100.00
	WP	4.35	9.30	13.21	100.00	100.00	100.00
	BP	4.48	9.10	11.79	100.00	100.00	100.00
	Control	9.66	21.74	28.05	100.00	100.00	100.00
L-49	WNP	1.13	3.08	3.89	28.15	50.67	100.00
	BNP	0.96	2.88	3.83	5.45	7.95	69.32
	WP	2.06	6.33	9.56	12.92	45.39	100.00
	BP	3.81	7.44	10.79	22.64	53.90	100.00
	Control	6.05	15.55	26.06	35.12	45.37	100.00
Kazi	WNP	0.37	1.09	1.72	2.31	3.05	3.66
	BNP	0.22	0.65	1.20	1.85	2.50	3.16
	WP	1.59	3.92	5.40	7.80	9.03	10.67
	BP	1.23	2.85	3.84	5.16	6.20	7.68
	Control	8.27	17.50	23.07	31.56	35.26	40.49
Madhuri	WNP	0.36	1.55	2.98	4.51	69.58	100.00
	BNP	0.49	1.95	2.77	4.51	37.12	100.00
	WP	1.22	4.68	6.54	9.47	88.85	100.00
	BP	1.20	4.04	6.61	10.58	80.05	100.00
	Control	4.50	13.24	19.28	25.55	71.79	100.00
Poly	WNP	1.78	4.07	5.25	100.00	100.00	100.00
	BNP	1.03	3.49	5.44	100.00	100.00	100.00
	WP	5.88	9.09	11.32	100.00	100.00	100.00
	BP	5.29	7.69	10.60	100.00	100.00	100.00
	Control	9.87	18.87	26.53	100.00	100.00	100.00
Mukandapuri	WNP	0.63	1.57	2.75	16.78	44.39	100.00
	BNP	0.45	1.87	11.00	17.24	48.29	100.00
	WP	1.07	3.84	19.82	25.63	69.75	100.00
	BP	1.56	3.46	5.14	6.95	35.32	100.00
	Control	6.76	16.39	22.61	39.49	49.20	100.00
LSD 5%	1.604	1.542	8.263	15.697	29.212	13.741	
1%	2.153	3.316	11.087	21.061	39.195	18.436	
Level of significance	**	*	**	**	**	**	

\* = Significant at 50% level

\*\* = Significant at 1% level

## Begum *et al.*: Shelf life of guava varieties under different post harvest treatments

loss was recorded from the fruits of Jelly, Apple and Poly (100%) and Kazi lost the lowest. The varieties Jelly, Allahabad, Apple and Poly showed 100% weight loss at 10 days after storage, but in case of 12 days after storing all the fruits of the varieties showed 100% weight loss except Kazi (13.13%), Swarupkathi (65.23%) and L-49 (93.88%).

**Effect of wrapping materials:** The effect of wrapping materials on weight loss of different guava varieties showed highly significant variation at 2, 4, 6, 8 and 12 days of storage. Different wrapping materials exhibited lower percentage of physiological weight loss at all storage duration as compared to using no wrapping materials i.e. in control treatment (Table 5). WNP and BNP showed better performance of physiological weight loss of fruits by which only 1.05% weight loss occurred at 2 days after storing against 7.69% by the control. Lower percentage of physiological weight loss at 4, 6 and 8 days after storage occurred in case of above mentioned two wrapping materials. WNP and WP gave lower physiological weight loss (7.46 and 0.86% respectively) as compared with control. At 10 days after storage black polythene bag (perforated and non perforated) gave lower percentage of weight loss than white polythene bag (perforated and non perforated) and control. At final stage (12 days after storage) perforated polythene bag (white and black) gave lower percentage of weight loss compared with non perforated (white and black) and also the control.

**Combined effect of varieties and wrapping materials:** Combined effect of different varieties and wrapping materials on weight loss of guava at different storage duration showed highly significant variation (Table 6). For each combination percentage of weight loss was found minimum in the initial stages of storage which gradually increased thereafter. This result is in agreement with the findings of Dutta *et al.* (1991). More weight loss occurred in control with all the varieties in all storage durations up to 10 days

in comparison with wrapping materials. At 12 days after storing comparatively lower percentage of physiological weight loss was recorded from Swarupkathi in BP (28%) and Kazi in BNP (3.16%), whereas fruits of all the varieties lost 100% weight loss in all treatments.

### Acknowledgments

The study was supported by Fruit Tree Improvement Project (FTIP) and research fellowship of the Ministry of Science and Technology, Peoples Republic of Bangladesh.

### References

- Bose, T.K. and S.K. Mitra, 1990. Guava. In: Fruits; Tropical and Subtropical. T.K. Bose (Ed.), Nayaprakash, India, pp: 280-303.
- Dutta, P., A.K. Banik, R. Ray Choudhury and R.S. Dhua, 1991. Influence of Ethylene absorbents on shelf life of guava fruits. *Indian J. Hort.*, 48: 213-216
- Gomez, K.A. and A.A. Gomez, 1984. *Statistical Procedures for Agricultural Research.* (2nd Ed.). IRRRI. Manila, Phillipines, pp: 188-198.
- Lashley, D., 1984. *Advances in Post-harvest Technology and New Technologies in Food Production.* Proc. Seminar. St. Augustine, pp: 173-183.
- Millar, R.J., 1976. Introduction. In: Proc. of National Food Loss Conf., Zaehring, M.V., (Ed.), College of Agriculture, University of Idaho, Moscow, pp: 102-108.
- Phandis, N.A., 1970. Physico-chemical composition of guava fruits. *Indian J. Hort.*, 27: 417-433.
- Rodriguez, R., B.I. Ranina, E.B. Pantastico and M.B. Batti, 1975. Quality of raw materials for processing. In: *Post-harvest Physiology, Handling and Utilization of Tropical and Subtropical Fruits and Vegetables.* Pantastico, E.B., (Ed.), AVI Publishing, Westport, Conn., pp: 467.