

Storage behaviour of mango (*Mangifera indica*) hybrids

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Several cultivars of mango (*Mangifera indica* L.) are of grown in various parts of the country. So far as research on mango cultivars for evaluating their post-harvest performance is concerned, vigorous efforts have been made in different parts of our country (Sahni and Khurdiya 1989). To regulate the marketing for the consumer acceptability and greater remuneration, it is necessary to study the storage behaviour of mango hybrids. Storage studies under ambient condition for newly released mango hybrids are lacking particularly under Sabour conditions. Therefore present study was conducted to evaluate the post-harvest physiological changes and economic life of fruits during storage at room temperature.

The hand-picked, firm and healthy fruits of uniform size and maturity, free from pests and diseases, injuries, bruises and blemishes were selected from the Horticultural Garden of Department of Horticulture, BAC, Sabour, during 1998. These were 'Prohashankar' ('Bombai' × 'Kalapady'), 'Mahmood Bahar' ('Bombai' × 'Kalapady'), 'Amrapali' ('Neelum' × 'Dashehari'), 'Mallika' ('Dashehari' × 'Neelum'), 'Ratna' ('Neelum' × 'Alphonso'), 'A.U.Rumani' ('Rumani' × 'Mulgoa'), 'Swarn Jehangir' ('Swarnarekha' × 'Jehangir'), 'Neeluddin' ('Neelum' × 'Himayuddin'), 'Nileshan' ('Neelum' × 'Baneshan'), 'Neelgoa' ('Neelum' × 'Mulgoa') and 'Langra' ('check cultivar'). The varieties differed in their maturity dates. 'Prohashankar' and 'Mahmood Bahar' were harvested on 10 June. 'Amrapali' and 'Mallika' were picked on 1 July and rest of the varieties were harvested on 20 June. Hundred fruits for each treatment were replicated thrice in a factorial completely randomized design. These fruits were stored at ambient temperature ranged between $33 \pm 2^{\circ}\text{C}$ (minimum) and $37 \pm 2^{\circ}\text{C}$ (maximum), with a relative humidity $82 \pm 3\%$. The physiological loss in weight, spoilage loss, TSS and acidity were determined by standard methods. Economic life (in days) of fruits was determined by counting the number of days, on the date after which cumulative spoilage percentage of fruits in particular variety exceeded 12% from the date of harvest of fruits, as further storage is supposed to be

uneconomical (Singh 1988).

Ascorbic acid and total sugar content were determined as per AOAC (1980). Analysis of total carotenoids was done as per the method suggested by Roy (1973). The respiration rate was measured by the continuous current method, in which CO_2 evolved was trapped in standard solution of barium hydroxide which was titrated against 0.1 N HCl (Loomis and Shull 1937).

The physiological loss in weight gradually increased in all the varieties with advancement of the storage period (Table 1). However, the rate of decrease in physiological loss in weight varied according to the varieties. 'Mallika' was most efficient in checking the loss in weight on all the days of observations and showed only 31.30% physiological loss in weight on day 15 of storage, followed by 'Ratna' (34.90%). 'Mahmood Bahar' was found most inferior, recording 44.00% loss on day 15 of storage. The weight loss with advancement of storage period might be due to the loss of moisture and food substances affected by the process of transpiration and respiration. Kumar and Dhawan (1995) and Kumar (1998) also recorded the similar trend in mango. Spoilage of mango fruits started on day 7 of storage in 'Mahmood Bahar', 'Amrapali' and 'Langra' (Table 1). In rest of the varieties, it started on day 9 of storage. The maximum spoilage loss was in 'Amrapali', while the minimum in 'Mallika' on day 15 of storage. Pathogens, variation in spoilage loss in different varieties might be due to varietal characteristics. Pathogens, viz *Aspergillus*, *Botryodiplodia* and *Diplodia* were detected from the rotten fruits. These findings are in the line with those of Kumar and Dhawan (1995), Kumar (1998) and Singh and Narayana (1999) in mango.

Respiratory activity of fruit was slow for first 5 days but later on it increased drastically showing a marked climacteric peak on day 9 of storage except 'Mallika' which showed climacteric peak on day 11 of storage. The highest respiratory activity was noted in 'Amrapali', followed by 'Prohashankar' and 'Mahmood Bahar'. 'Mallika' recorded the lowest respiration rate during climacteric rise. Similar results were obtained by Yanru Zeng *et al.* (1995) in 'Amrapali', 'Dashehari' and 'Rataul' varieties of mango. Carotenoid pigments are the precursor of vitamin A and nutritionally

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Table 2 Changes in TSS acidity, ascorbic acid and total sugar during storage of mango fruits

Variety	Days after harvest							Days after harvest									
	1	3	5	7	9	11	15	1	3	5	7	9	11	13	15		
	TSS																
'Probhashankar'	9.70	13.90	17.10	19.00	19.00	20.30	19.00	18.20	18.00	1.70	1.50	0.78	0.51	0.38	0.30	0.20	0.10
'Mahmood Bahar'	9.60	13.60	17.00	18.80	20.00	18.70	18.00	18.00	17.10	1.60	1.46	0.75	0.50	0.36	0.31	0.19	0.11
'Amrapali'	10.34	14.00	19.93	22.90	23.40	21.80	19.00	19.00	18.00	1.20	0.90	0.67	0.36	0.22	0.18	0.09	0.06
'Mallika'	10.13	13.70	17.50	20.40	22.40	23.00	22.00	22.00	21.00	1.48	0.93	0.54	0.40	0.29	0.10	0.08	0.07
'Ratna'	6.95	12.00	14.30	18.00	21.10	19.00	17.80	17.80	17.40	1.89	1.20	0.90	0.60	0.43	0.39	0.29	0.21
'A.U. Rumani'	6.33	11.30	13.67	16.90	19.90	17.60	17.00	17.00	16.10	1.35	1.02	0.69	0.43	0.34	0.30	0.14	0.11
'Swarn Jehangir'	8.33	11.70	14.00	17.00	19.00	17.80	17.10	17.10	16.00	1.40	1.10	0.70	0.44	0.36	0.29	0.13	0.10
'Neeluddin'	7.00	12.00	17.00	18.80	20.00	19.50	17.70	17.70	17.00	1.30	0.99	0.80	0.49	0.40	0.32	0.19	0.12
'Neelshan'	7.10	12.34	17.51	18.90	20.10	19.60	17.90	17.90	17.10	1.60	0.80	0.78	0.46	0.37	0.30	0.18	0.11
'Neelgoa'	7.50	12.94	17.90	18.97	20.23	19.00	17.30	17.30	16.70	1.50	0.90	0.70	0.49	0.33	0.29	0.17	0.12
'Langra (check)'	7.20	12.40	16.00	19.00	21.00	19.13	18.60	18.60	18.00	1.33	0.93	0.68	0.49	0.38	0.29	0.19	0.10
CD (P=0.05)																	
Varieties (V)	0.08																
Days (D)	0.09																
VxD	0.008																
	Ascorbic acid (mg/100 g pulp)																
	Total sugar (%)																
'Probhashankar'	86.00	75.11	52.20	38.34	30.17	25.00	15.00	12.34	4.00	9.99	15.10	16.79	15.00	14.01	13.00	12.21	
'Mahmood Bahar'	87.00	78.00	50.00	45.00	32.00	26.00	16.90	13.11	4.10	9.70	15.00	16.20	14.80	13.90	12.70	12.10	
'Amrapali'	125.00	115.00	101.00	80.00	50.34	39.00	19.80	15.90	5.00	10.00	16.00	18.78	19.80	19.70	17.00	14.34	
'Mallika'	115.00	105.00	90.80	60.43	39.00	28.00	15.90	12.30	4.80	9.80	15.10	17.71	19.10	19.60	17.80	15.99	
'Ratna'	60.34	50.11	38.34	26.00	18.11	14.00	12.90	6.09	5.60	8.99	13.10	16.17	18.99	18.10	15.13	15.10	
'A.U. Rumani'	61.00	49.00	39.00	29.00	17.00	13.00	10.34	5.19	4.00	9.81	12.99	14.00	15.31	14.10	13.00	12.60	
'Swarn Jehangir'	75.00	60.00	52.00	31.00	19.00	12.00	10.13	9.00	4.34	9.99	12.87	15.80	15.99	15.10	13.60	13.00	
'Neeluddin'	80.00	70.00	59.39	35.00	18.00	13.00	12.00	8.00	4.19	9.00	12.78	15.70	15.80	14.87	13.11	12.90	
'Neelshan'	90.17	53.00	40.00	35.90	20.10	15.00	11.00	5.00	5.01	9.34	13.00	16.00	16.11	15.03	13.34	12.87	
'Neelgoa'	85.00	71.00	52.00	45.00	40.00	31.00	25.00	12.00	5.11	9.60	12.00	16.10	16.34	15.00	14.13	12.93	
'Langra (check)'	130.00	106.00	90.00	67.00	40.00	29.00	17.00	14.00	4.95	11.00	16.10	17.00	17.00	16.50	14.00	13.87	
CD (P=0.05)																	
Varieties (v)	0.14																
Days (D)	0.16																
VxD	0.04																

important. Total carotenoid was maximum in 'Amrapali', followed by 'Mallika', 'Neeluddin' and 'Neeleshan'. It increased up to day 9 of storage in all the varieties except 'Mallika' in which peak was recorded on day 11 of storage and thereafter declined. Carotenoid reduction occurs at over-ripe stage in several varieties of mango (Sahni and Khurdiya 1989).

On the basis of spoilage within 12 %, the maximum economic life was shown by 'Mallika' and 'Ratna', ie 15 and 11 days respectively. The TSS content of different cultivars increased up to day 9 of storage except 'Mallika' in which it was up to day 11 and declined thereafter till the termination of storage (Table 2). Increase in TSS during ripening is associated with the transformation of pectic substances, starch, hemicellulose or other polysaccharides in soluble sugar and dehydration of fruits (Bhullar *et al.* 1981). After peak of ripening a decrease in TSS might be due to senescent changes after the fruit had attained a climacteric peak. Sahni and Khurdiya (1989) also reported similar results in mango.

During storage, the titratable acidity gradually decreased in all the varieties (Table 2). The acidity during storage might be converted into sugars and their derivatives or used in respiration and was responsible for this decreasing trend. Bhullar *et al.* (1981), Kumar and Dhawan (1995) and Kumar (1998) also recorded similar results in mango.

The ascorbic acid content of fruits decreased gradually during storage in all the varieties (Table 2). Variation in decreasing trend might be due to different level of oxidation in different varieties. This finding is in agreement with the finding of Kumar (1998) in mango.

The initial value of total sugar increased with the advancement of storage period up to day 7 of storage in 'Prabhashankar' and 'Mahmood Bahar', while up to day 9 in other varieties except 'Mallika' in which it increased up to day 11 of storage and declined thereafter (Table 2). These findings are in close agreement with the findings of Sahni and Khurdiya (1989). The changes in sugar during storage are very much related with TSS. An increase in sugar up to certain period during storage was probably due to conversion of starch and polysaccharides into soluble sugars and dehydration of fruits. Similar results were obtained by Pandey *et al.* (1974) in mango. The decline of total sugar after attaining the peak might be due to its faster utilization in respiration, when the fruits were over-ripe. Similar results were recorded by Yanru Zeng *et al.* (1995) in mango.

SUMMARY

Physico-chemical changes and economic life of fruits of

'Prabhashankar', 'Mahmood Bahar', 'Amrapali', 'Mallika', 'Ratna', 'A.U.Rumani', 'Swarn Jehangir', 'Neeluddin', 'Neeleshan', 'Neelgoa' and 'Langra' (check cultivar) mango (*Mangifera indica* L.) were studied during storage at ambient temperature under Sabour conditions during 1998. 'Mallika' variety was found most efficient in retaining its physiological loss in weight, TSS and total sugar during storage. It was also having less spoilage loss and exhibited excellently 15 days of storage life. The highest rate of respiration was noted in 'Amrapali', whereas the lowest in 'Mallika'. 'Ratna' mango also exhibited good storage behaviour (11 days). Other varieties could be stored up to day 9 at ambient temperature. Low rate of respiration and less incidence of pathogens were the main cause of higher shelf-life of Mallika fruits.

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