https://doi.org/10.56093/ijas.v90i3.101489

Indian Journal of Agricultural Sciences **90** (3): 585–8, March 2020/Article

Evaluation of post-harvest quality of some mango (*Mangifera indica*) genotypes during storage

AYE MOH MOH AUNG, R R SHARMA*, SHRUTI SETHI and MANISH SRIVASTAV

ICAR-Indian Agricultural Research Institute, New Delhi 110 012, India

Received: 13 June 2019; Accepted: 15 July 2019

ABSTRACT

Mango (*Mangifera indica* L.) is known as the 'King of the fruits' in India and contributes largely to total fruit production. In addition to several superior varieties of mango, several new hybrids or varieties are added every year which have not been assessed for their storage behaviour. Hence, we conducted study on storage behaviour of 12 hybrids/varieties grown under Delhi conditions. For this, fruits of selected varieties were harvested at full maturity and after ripening, stored at 12°± 1ºC and 85–90% RH for further observations at 3 days interval. Our results revealed that the PLW was the lowest in Pusa Arunima (4.8%) which increased with the increase in storage period. Interestingly, genotypes such as Amrapali, Pusa Arunima, Pusa Lalima, Pusa Pratibha, Pusa Shreshth, Pusa Surya and Sensation exhibited <10% PLW. Similarly, total carotenoid content was the highest in Pusa Arunima (7.47 mg/100g).The overall acceptability score was the highest in Pusa Arunima (8.54) and the lowest in Langra (6.20). Based on these observations, it can be revealed that Pusa Arunima excelled all other varieties/hybrid in storage life (12 days) and other quality attributes.

Key words: Physiological loss in weight, Sensory evaluation, Storage life, Total carotenoids

Mango (*Mangifera indica* L.) is commercially cultivated in several tropical and subtropical regions of the world. It is called as the 'King of the fruits' in India, and has historical, religious and economic importance. At present, India is producing 20714 thousand metric tonnes (MT) of mangoes from an area of 2259 thousand hectare with productivity level of 9.16 MT/ha (Sharma and Krishna 2014). There are about 1,600 varieties of mango in the world but only few dozen are grown commercially and India grows a large number of mango varieties such as Dashehari, Langra, Bombay Green, Chausa, Amrapali, Mallika, Neelum, Banganpalli, Alphonso, Totapuri, Kesar, Fazli etc. In addition, several research institutes have been working on improvement in mango, and have developed several hybrids/varieties. These mango varieties have their own demand and commercial importance in processing industry. The consumer preference for a particular trait varies from region-to-region and mainly based on appearance, flavor, aroma and quality of fruits, and important commercial mango varieties have their unique taste and flavour (Sharma and Krishna 2014).

Mango is mostly eaten as fresh fruit but also processed to juices, jams, jellies, nectars as well as to crisp mango chips (Hamdard *et al.* 2004). Generally, mango is consumed at all stages of fruit development from the tiny imperfectly set fruits to the fully mature ones. The nutritional value of mango varies from variety-to-variety and developmental stages of the fruit including mature and ripened stage (Leghari *et al.* 2013). Some studies have been conducted on the physico-chemical characteristics of different mango varieties (Hamdard *et al.* 2004, Akhter *et al.* 2010). Similarly, ICAR-IARI has developed several mango hybrids/varieties in last few decades but their assessment for storage life has not been addressed. Thus, there is scarcity of literature on the storage behaviour of newly developed and released mango varieties and hybrids. Considering these points in mind, the present study has been conducted.

MATERIALS AND METHODS

The present experiment was conducted at the ICAR-IARI, New Delhi during 2018–19. Twelve hybrids/varieties of mango including Langra, Dashehari, Pusa Lalima, Pusa Shreshth, Pusa Pratibha, Mallika, Amrapali, Pusa Surya, Hybrid 8-11, Pusa Peetamber, Pusa Arunima and Sensation were selected for this study. Fully mature fruits were harvested from the orchard of Division of Fruits and Horticultural Technology, ICAR-IARI, New Delhi and brought to laboratory. In the lab, fruits were de-sapped and ripened in ethylene ripening chamber. The ripened fruit were stored at 12 ± 1º C and 85–90 % RH and observations on different attributes were recorded at 3 days up to 12 days.

Determination of physiological loss in weight (PLW): Individual mango fruits from each treatment were marked for recording physiological loss in weight. High precision

*Corresponding author e-mail: rrs_fht@rediffmail.com

electronic balance (Make: Pricisa 310 M) was used to weigh the fruits. Thereafter, the fruits were recorded regularly during storage and the cumulative PLW was expressed in percentage (%).

Determination of quality and functional attributes: The total soluble solids of mango fruit pulp samples were estimated using FISHER Hand Refractometer (range 0–50), and expressed in % (AOAC 2006). Total carotenoid content was determined by the method of AOAC (2006) and expressed as mg 100/g FW (fresh weight).

Sensory evaluation: 'Panel method' using hedonic scale (0–9 scale) was followed for sensory evaluation of mango fruits (Prasad *et al.* 2016a) in which 9 indicates highly preferable, 8- very much preferable, 7- moderately preferable, 6- slightly preferable, 5- neither preferable nor non preferable, 4- slightly non preferable, 3- moderately non preferable, 2- very much non preferable, and 1 indicated extremely non preferable.

Statistical design and analysis of data: The data recorded from various experiments were subjected to statistical analysis. Analysis was carried out with IndoStat software package and MS Excel® spread sheet. Experiment was laid out in CRD with three replications per treatment. Valid conclusions were drawn only on significant differences between the treatment mean at 0.05 level of probability. In order to compare treatment means, critical differences were calculated.

RESULTS AND DISCUSSION

Physiological loss in weight (PLW): The physiological loss in weight is one of the most important factors which determine the shelf life of fruits (Kader 2002). In this study, it was observed that the genotype, storage interval (days) and the interaction, genotype × days significantly influenced the PLW (Table 1). The PLW was the highest in Hybrid 8-11 (9.7%) and the lowest in Pusa Arunima (4.8%) which increased with the increase in storage period. The interaction, genotype × days was also significant as the lowest PLW was recorded in Pusa Arunima on 3rd day of storage and the highest in Mallika on 12th day of storage (Table 1). Interestingly, all mango genotypes exhibited <10% PLW up to 6th day of storage but on 9th day of storage, five genotypes such as Dashehari, Hybrid 8-11, Langra, Mallika and Pusa Peetamber showed >10% PLW. However, genotypes such as Amrapali, Pusa Arunima, Pusa Lalima, Pusa Pratibha, Pusa Shreshth, Pusa Surya and Sensation exhibited <10% PLW. None of genotypes except Pusa Arunima (7.8%) exhibited <10% PLW (Table 1). The significant variability in PLW among genotypes might be due to genetical differences among genotypes (Prasad *et al.* 2016a). The PLW is largely determined by loss of moisture from the fruits by respiration or transpiration which in turn is governed by peels thickness or environmental factors. The lower PLW in some mango genotypes (e.g. Pusa Arunima, Pusa Lalima, Pusa Pratibha, Pusa Shreshth, or Pusa Surya) may be due higher peel thickness, lower respiration rate or transpiration rate or concentration of lenticels (Prasad and Sharma 2016).

In contrast, higher PLW in other genotypes may be due higher moisture loss, mediated by lesser peel thickness and higher respiration or transpiration rate. In this study, 'Pusa Arunima' was observed to be best genotype as it displayed very less PLW even on 12th day of storage, primarily because of thick peel and low respiration rate than all other genotypes. Furthermore, increase in PLW with the increase in storage period may be attributed to higher moisture loss,

Table 1 Changes in physiological loss and total soluble solids of different mango genotypes during low temperature storage

	Physiological loss in weight (%)					Total soluble solids (%)				
	Storage period (days)									
	3	6	9	12	Mean	3	6	9	12	Mean
Amrapali	4.5	6.4	9.3	12.8	8.3	23.0	22.5	20.0	17.3	21.0
Dashehari	3.7	8.4	10.5	13.0	8.9	21.0	20.8	18.0	16.4	19.4
Hybrid 8-11	4.6	9.8	11.3	13.2	9.7	19.4	18.0	18.8	16.0	18.1
Langra	4.0	8.9	10.8	13.5	9.3	20.8	19.2	17.4	15.2	18.5
Mallika	3.8	8.2	10.0	14.6	9.1	23.6	22.0	20.0	18.2	21.4
Pusa Arunima	2.2	3.8	5.2	7.8	4.8	19.6	20.0	19.5	19.0	19.3
Pusa Lalima	3.3	6.2	9.2	12.6	7.8	19.8	19.6	19.2	17.4	19.0
Pusa Peetamber	4.6	9.0	10.2	12.5	9.1	19.8	18.2	17.8	15.2	17.9
Pusa Pratibha	3.6	6.9	9.8	12.8	8.3	20.5	19.4	18.2	16.4	18.9
Pusa Shreshth	4.5	7.3	9.1	12.4	8.3	20.5	19.0	18.4	16.8	18.9
Pusa Surya	4.0	7.0	9.5	11.9	8.1	19.2	18.5	17.8	16.0	18.0
Sensation	2.3	5.4	9.2	10.8	6.9	16.0	15.2	14.0	13.0	14.7
Mean	3.8	7.3	9.5	12.3		20.3	19.4	18.3	16.4	
SE(m)	Genotype = 0.06, Days = 0.04, Genotype × days = 0.13					Genotype =0.1, Days=0.1, Genotype × days=0.3				
CD (P=0.05)	Genotype = 0.16, Days = 0.1, Genotype × days = 0.36					Genotype =0.4, Days=0.3, Genotype × days=0.9				

Table 2 Total carotenoid content and sensory score of different mango genotypes during low temperature storage

	Total carotenoid content (mg/100g)					Sensory score (0-9 scale)				
	Storage period (days)									
	3	6	9	12	Mean	3	6	9	12	Mean
Amrapali	8.00	7.60	6.80	5.00	7.04	7.80	7.00	6.20	4.80	6.68
Dashehari	4.60	4.30	4.00	3.40	4.14	7.80	6.20	5.50	5.10	6.34
Hybrid 8-11	5.80	5.40	5.20	3.80	5.18	7.80	6.30	6.40	5.80	6.76
Langra	4.10	3.70	3.40	3.00	3.63	7.60	6.00	5.80	4.40	6.20
Mallika	6.00	5.80	5.20	4.60	5.45	8.20	8.00	7.60	6.80	7.72
Pusa Arunima	8.50	8.60	7.20	5.80	7.47	8.80	8.60	8.40	8.20	8.54
Pusa Lalima	6.00	5.80	5.00	3.50	5.19	7.80	6.80	6.20	5.60	6.80
Pusa Peetamber	6.99	5.80	5.00	4.20	5.63	7.60	6.20	5.50	4.80	6.32
Pusa Pratibha	6.20	5.60	4.80	3.20	5.12	7.20	6.50	6.00	5.50	6.46
Pusa Shreshth	6.52	6.65	5.20	5.00	5.89	7.90	8.10	6.30	5.80	7.18
Pusa Surya	4.70	5.00	4.50	3.20	4.29	8.20	8.00	7.20	6.70	7.68
Sensation	4.00	3.80	3.00	2.80	3.34	7.50	7.70	6.80	4.60	6.78
Mean	5.95	5.67	4.94	3.96		7.85	7.20	6.50	5.70	
SE(m)	Genotype =0.04, days =0.02, Genotype × days = 0.08					Genotype =0.05, days=0.03, Genotype × days = 0.12				
CD (P=0.05)	Genotype =0.10, days =0.07, Genotype × days =0.23					Genotype =0.15, days=0.10 Genotype × days = 0.33				

respiration rate and other metabolic activities. Similarly, the interactive effect of genotypic variations and storage period might have influenced the PLW of mango fruits.

Quality attributes: The significance difference occurred among mango genotypes for total soluble solids content (Table 1). Irrespective of storage period, the total soluble solids were the highest in Mallika (21.4%) and the lowest in Sensation (14.7%). Most of the recently released hybrids such as Pusa Arunima (19.3%), Pusa Lalima (19.0%), Pusa Pratibha (18.9%) and Pusa Shreshth (18.9%) exhibited medium concentration for TSS (Table 1). In general, the total soluble solid content increased up to 3rd day of storage and then it declined up to 12th day of storage. The interaction, genotype × days was also significant as the highest total soluble solids was recorded in Mallika on 3rd day of storage and the lowest in Sensation on 12th day of storage (Table 1). A significant variability in TSS content of different mango genotypes may be attributed to genetic variability existing among the mango genotypes (Prasad *et al.* 2016b). In a similar study, Narvariya *et al.* (2017) have also reported variability in TSS of different mango genotypes. Adree *et al.* (2010) observed similar variability in TSS content of guava genotypes grown in Pakistan. Furthermore, the synergistic and interactive effect of genotypic differences and storage days might have influenced the TSS content of the mango fruits.

Mango is a rich source of carotenoids, which is not only the source of antioxidants but also a precursor of vitamin A. In the present study, it was observed that genotype, storage interval (days) and the interaction, genotype × days significantly influenced the total carotenoid content of different mango genotypes (Table 2). The total carotenoid content was the highest in Pusa Arunima (7.47 mg/100g) and the lowest in Sensation (3.34 mg/100g). Furthermore, the total carotenoid content has increased up to 3th day of storage, but then followed a declining trend thereafter. Among the storage days, the highest carotenoid content was recorded by mango fruits on 3th day of storage and lowest on 12th day of storage (Table 2). The interaction, genotype × storage period for total carotenoid content was also significant. Our study got a support from the results of Melo *et al.* (2011) who reported that there was a significant difference in total carotenoids, and some functional attributes among different mango genotypes. A significant variability in carotenoid content in mango genotypes has also been reported by Gil *et al.* (2002). Increase in carotenoid content up to 3rd day and then decline thereafter may be due to the fact that initially the mango fruits got fully ripened but decline thereafter may be due to utilization in different metabolic activities. Furthermore, the synergistic effect of genotypic variations and storage period might have significantly influenced the total carotenoid content in mango fruits.

Sensory evaluation: The sensory evaluation is an overall acceptance of mango fruits (Nath *et al.* 2006, Singh *et al.* 2012). The overall evaluation was done on the basis of colour, taste, flavor of the fruits. Our results elucidated that the genotype, storage interval (days) and the interaction, genotype × days significantly influenced the sensory score of mango fruits (Table 2). Irrespective of storage, the overall acceptability value was the highest in Pusa Arunima (8.54) and the lowest in Langra (6.20). Some genotypes such as Mallika, Pusa Surya, Pusa Shreshth and Pusa Lalima have good acceptability score (Table 2). The overall acceptability values increased initially up to 3rd day of storage but then decreased and reached to the lowest value on 12th day of storage (5.70) (Table 2). The higher sensory score by some

genotypes, viz. Pusa Arunima, Mallika, Pusa Surya, Pusa Shreshth and Pusa Lalima might be due to better colour, taste and flavor and *vice versa* (Prasad *et al.* 2016a). The decrease in sensory score with the increase in storage interval may be due to decline in colour and internal quality attributes such as TSS, carotenoids and flavonoids.

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