

Fruit Quality of Different Mango (*Mangifera indica* L.) Cultivars Grown in the Foothills of Shiwaliks

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Abstract

The present study describes the post-harvest evaluation of eight mango (*Mangifera indica* L.) cultivars viz., Dashehari, Langra, Chausa, Safeda, Ramkela, Sinduri, Amrapali, Mallika being grown in the eroded soils of the foothills of Shiwaliks. Plantation of uniform sized plantlets of different cultivars was raised under uniform edaphic conditions in the Research farm of ICAR-Indian Institute of Soil and Water Conservation, Research Farm, Panchkula (Haryana), India in year 2000. Postharvest evaluation of different cultivars was carried out for the year 2008, 2009 and 2010. Data for the different post-harvest quality parameter were recorded. The lowest cumulative yield of 3 years crop was 28.7 kg tree⁻¹ which was recorded for the cultivar Sinduri whereas the highest yield was recorded for the cultivar Mallika. Physiologically matured and ripe fruits were utilized for physical-biochemical analysis. The qualitative analysis of fruits indicated the superiority of hybrid Mallika in terms of total soluble solids, titrable acidity, TSS: acid ratio, sugar content, stone, peel and pulp attributes and lowest percent physiological loss in weight during ripening in comparison to other cultivars evaluated in the study.

INTRODUCTION

Shiwalik foothills are spread in 3.1 million ha in the States of Jammu and Kashmir, Himachal Pradesh, Punjab, Haryana and Uttarakhand (Prasad et al., 2007). The regions receive an average annual rainfall of 1100 mm which is mostly received in the monsoon season i.e. between the months of June and September. The erratic distribution of rainfall causes water induced soil erosion during monsoon and moisture stress during remaining eight months i.e. from October to May.

Mango (*Mangifera indica* L.) is one of the choicest and profitable fruit crops of tropical and sub-tropical regions and acclaimed as 'King of fruits' in the tropical world. India is the largest producer of mango, covers around 36% of the total geographical followed by China, Thailand, Philippines and Mexico, and accounts 20.3% of total fruit production of the country (NHB, 2011). The trees have strong frame work of branches and deep tap root system which can withstand several edaphic, biotic and abiotic

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extremes. Most of the cultivars hence, recorded their normal plant growth and development characteristics in the region but screening of the potential cultivars for quality cropping behaviour and fruit production is the need of the hour. In view of the above aspects, the present study has been therefore, planned and focused to evaluate fruit production and quality of different mango cultivars under the agro-ecological conditions of Shiwalik foothills.

MATERIALS AND METHODS

The experimental plants were transplanted in the year 2000-2001 at Research Farm of Indian Institute of Soil and Water Conservation, Panchkula (Haryana), India located at latitude 30°43'36" North and 76°51'35" East longitude at an elevation of 371 m above mean sea level. The climate of the region is sub-tropical humid with an annual average rainfall of 1118.8 mm. The plants were grown under uniform agro-ecological conditions and according to the package of practices to raise an ideal mango crop in the region. The observations were recorded from the mango crop of 8th to 10th year of tree age. The study was carried out in the year 2008, 2009 and 2010. Total yields and cumulative yield (kg tree⁻¹) were computed from the harvest data for that season as well as for cumulative 3-year yield. An

overall yield efficiency was also calculated by dividing the mean of 3-year yield. For determination of quality parameters of fruits ten numbers of mature and ripe fruits of each cultivar were harvested randomly from all the directions. Maturity of the fruits was judged on the basis of optimum total soluble solids (TSS, °Brix) and the appearance of prominent lenticels of off white color (Chadha et al., 2004). The fruits were peeled with the pulp, stone and peel separated. Each fraction was weighed. Physical parameters like fruit length, width, thickness and weight for fresh fruit, and subsequently stone, peel and pulp characteristics were recorded independently. Vernier caliper was used to measure physical parameters of the fruit samples, whereas, fruit volume was recorded by using water displacement method. TSS was determined using hand held refractometer (0-32°, ERMA); acidity by titration method by 0.1N NaOH solution using phenolphthalein; sugar content; ascorbic acid was determined titrimetrically using 2, 6-dichlorophenolindophenol visual titration method (Ranganna, 1986), and total carotenoids in the fruit samples were estimated using standard procedures (A.O.A.C., 1980). The statistical analysis was carried out using analysis of variance to evaluate the comparative performance among mango cultivars (Panse and

Sukhatme, 1985). The Least Significant Differences (LSD) was used to compare the means at 5% level of significance.

RESULTS AND DISCUSSION

Fruit yield and yield efficiency

Highest fruit yield (kg tree⁻¹) among mango cultivars was obtained in Langra in the year 2010. Maximum mean fruit yield was also recorded in cultivar Langra, followed by Dashehari and Mallika. The mean of fruit yield obtained in the cultivars Safeda, Ramkela, and hybrid Amrapali was statistically similar to each other. Mango trees of cultivar Sinduri exhibited the poorest total yields. Highest cumulative yield was noticed in Mallika, Amrapali, and Safeda, whereas, the lowest cumulative yield was recorded in cultivar Sinduri (Table 1).

Table 1: Fruit yield, cumulative yield, yield efficiency and degree days between fruit set and maturity of mango cultivars the end of 10th vegetation.

Cultivar/ hybrid	Yield (kg tree ⁻¹)				Cumulative yield (kg tree ⁻¹)	Degree days between fruit set and maturity
	2008	2009	2010	Mean		
Amrapali	10.70	13.40	14.20	12.8	77.6	1659.4
Mallika	13.23	15.67	16.17	15.0	91.1	2101.5
Dashehari	16.67	5.53	26.17	16.1	69.2	2343.6
Langra	17.20	7.00	28.43	17.5	71.9	2163.3
Chausa	12.37	3.13	15.97	10.5	47.8	2346.2
Lucknow Safeda	12.73	14.73	15.90	14.5	73.4	2372.9
Ramkela	13.73	5.70	23.20	14.2	63.4	2298.7
Sinduri	5.37	3.20	5.67	4.7	28.7	2107.5
C.V (%)	9.9	11.6	9.0	7.9	7.2	2.20
LSD _{0.05}	2.21	1.74	2.87	1.8	8.2	83.6

Physical and biochemical characteristics of fruits

The data presented on physical characteristics of fruits of mango cultivars

showed that fruit dimensions showed significant differences to each other (Table 2). The hybrid Mallika had the superiority in terms of fruit measurements such as length, width, and thickness among all other cultivars evaluated. Regardless of the dimensions of fruits, all the varieties were more or less equal.

It was also noted that the cultivar Ramkela produced the smallest fruits. Mallika had maximum dimension of fruits and hence, is being considered as a desirable cultivar. However, the earlier studies had revealed that the mango cultivars differed in fruit dimensions of fruit length, width and thickness according to their genetic makeup. In the case of fruit weight and volume, Mallika was followed by Langra and Safeda, and the lowest value was noticed in the cultivar Dashehari. Bibi et al. (2006) and Bihari et al. (2012) also recorded heavier fruit of the cultivar Mallika. Sarkar et al. (2001) reported that as the fruit size in various cultivars differed and also varied within the cultivars studied. No significant difference could be noticed between varieties in terms of specific gravity. Mallika, Chausa and Sinduri had a specific gravity of 1.07 g cc⁻¹ each, whereas, it was least in the hybrid Amrapali (1.04 g cc⁻¹).

Table 2: Physical and biochemical quality characteristics of fresh mango fruits at maturity stage

Cultivar/ hybrid	Fruit Dimensions (cm)			Fruit weight (g)	Fruit volume (cc)	Specific gravity (g cc ⁻¹)	TSS (°Brix)	Acidity (%)	TSS: acid ratio	RS (%)	NRS (%)	TS (%)	Ascorbic acid mg/100 g of pulp)	Total Carotenoids (µg/100 g of pulp)
	Length	Breadth	Thickness (cm)											
Amrapali	10.0	5.9	5.5	171.7	165.0	1.04	20.3	0.19	95.89	2.59	13.72	17.04	34.5	13.68
Mallika	12.3	7.6	7.0	360.0	336.7	1.07	21.1	0.17	100.41	2.60	14.53	17.91	33.7	8.75
Dashehari	10.9	7.4	6.9	157.0	145.9	1.06	19.2	0.20	90.98	2.53	13.00	16.21	26.2	6.67
Langra	10.2	6.1	5.8	298.7	281.7	1.06	18.4	0.23	79.53	2.32	12.07	15.02	29.2	4.53
Chausa	10.2	7.1	5.8	221.0	206.7	1.07	19.1	0.22	104.38	2.24	13.18	16.11	30.4	7.13
Safeda	10.3	6.7	6.4	286.3	270.0	1.06	17.3	0.23	77.00	2.21	11.23	14.03	25.7	5.28
Ramkela	7.4	6.1	5.0	168.0	158.3	1.06	18.3	0.30	61.07	2.19	12.38	15.22	26.2	4.34
Sinduri	7.8	6.0	6.1	168.3	156.7	1.07	16.9	0.26	57.83	2.04	11.55	14.20	28.1	3.95
C.V. (%)	6.2	3.7	4.2	12.5	12.1	2.9	5.5	8.77	9.71	3.07	3.19	2.99	7.57	9.63
LSD _{0.05}	1.1	0.4	0.5	51.7	47.3	NS	1.7	0.03	14.17	0.13	0.71	0.82	3.9	1.14

Table 3: Post ripening physical attributes of mango in eroded soils

Cultivar/ hybrid	Weight (g)	Physiological loss in weight (%)	Stone					Peel			Pulp	
			Weight (g)	Dimensions			Percentage in ripe fruit	Weight (g)	Thickness (cm)	Percentage in ripe fruit	Weight (g)	Percentage in ripe fruit
				Length (cm)	Width (cm)	Thickness (cm)						
Amrapali	166.0	3.2	24.2	8.7	3.0	1.8	14.6	28.7	1.2	17.3	113.7	68.4
Mallika	331.7	7.8	34.0	10.5	4.1	1.9	10.2	44.0	1.6	13.4	252.0	76.4
Dashehari	210.0	4.2	23.8	9.6	3.1	1.7	11.3	36.3	1.2	17.3	149.8	71.3
Langra	280.7	6.0	20.3	7.6	3.5	1.5	7.4	36.0	1.1	12.9	224.3	79.7
Chausa	200.3	9.3	30.4	8.9	3.2	1.6	15.2	24.5	1.2	12.2	145.4	72.6
Safeda	278.3	2.8	18.7	8.3	4.1	1.6	6.7	35.0	1.1	12.7	224.7	80.6
Ramkela	161.7	3.8	23.0	5.5	3.6	2.1	13.7	30.3	2.6	18.9	109.3	67.4
Sinduri	156.0	7.5	31.7	6.8	5.1	2.2	20.1	22.0	1.1	14.2	102.3	65.7
C.V. (%)	12.4	14.3	18.8	8.8	5.6	12.7	10.6	12.7	5.3	10.0	13.7	2.8
LSD _{0.05}	48.5	1.4	8.5	1.3	0.4	0.4	2.3	7.2	0.1	2.6	39.6	3.6

The results of the qualitative analysis of the fruits indicated the superiority of hybrid Mallika in terms of total soluble solids (TSS, 21.1 °B), lowest titrable acidity (0.17%), reducing sugars (2.60%), non-reducing sugars (14.53%) and total sugars (17.91%) compared to other cultivars (Table 2). TSS to acid ratio ranged from 57.83 to 104.38. Chausa, followed by hybrid Mallika had the maximum TSS to acid ratio. TSS: acid ratio in Amrapali was 95.89. The hybrid Amrapali registered the highest ascorbic acid (34.5 mg/100 g of pulp) and total carotenoids (13.68 µg/100 g of pulp),

followed by hybrid Mallika with corresponding values of 33.7 mg/100 g of pulp and 8.75 µg/100 g of pulp, respectively.

Post ripening quality attributes

The data presented on the post ripening physical attributes namely, fruit weight, and stone, peel and pulp characteristics are presented in Table 3. Maximum fruit weight was exhibited by hybrid Mallika, followed by the cultivars Langra, Safeda, Dashehari and Chausa. The results also inferred that Chausa exhibited highest

(9.3%) loss in physiological weight during post ripening period, whereas, it was minimum in hybrid Amrapali (3.2%). All the cultivars were statistically differed in stone characteristics. Maximum stone weight was recorded in hybrid Mallika (34.0 g) followed by the cultivars Sindhuri, Chausa, Amrapali with corresponding values of 31.7, 30.4, 24.2 g, respectively. Maximum percent of stone in ripe fruit was assessed in Sindhuri (20.1%), whereas, the cultivar Safeda recorded it the least (6.7%). Similarly, all the cultivars also recorded the peel attributes with a significant statistical difference. The hybrid Mallika ranked first in pulp weight (252.0 g) among all cultivars. However, the cultivars Safeda, Langra, Dashehari also showed good pulp weight with corresponding values of 224.7, 224.3, 149.8 g, respectively (Table 2). Sindhuri' recorded the lowest pulp weight (102.3 g) due to comparative smaller fruit dimension. Maximum percent pulp of ripe fruit was assessed in 'Safeda (80.6%) followed by Langra (79.7%), whereas, the cultivar Sindhuri recorded the least (65.7%).

CONCLUSIONS

This study has demonstrated the varietal evaluation of eight mango cultivars grown in the eroded soils of Shiwalik foothills

which is located in the lower Himalayas. A significant variation in the fruit yield and post-harvest quality parameters were recorded. Maximum cumulative yield was recorded for cultivar Mallika. Yield efficiency was differed markedly amongst all cultivars studied. The qualitative and post ripening quality characteristics analysis indicated the superiority of hybrid Mallika to be considered it as a desirable cultivar compared to other cultivars evaluated.

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