

## Characterization of Different Cultivars of Mango Commercially Grown in Malda, India

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### Abstract

Fruits of eighteen mango varieties (Amrapali, Ashwina, Fazli, Gopalbhog, Khirshapati, Lakshmanbhog, Langra, Baishakhi Gooti, Rakhalbhog, Golapphas, Ashudagi, Arajanna, Mallika, Krishanbhog, Michrikanta, Laxmibhog, Phunia and Brindabani) were collected from eight mango growing blocks of two Sub-divisions of Malda district. Both physico-chemical parameters were assessed at optimum ripening condition of fruits. Among the mango cultivars, the fruits of Fazli and Mallika were superior to others with regard to fruit weight and size. Phunia was the smallest in weight and size. The proportion of edible portion was highest in cv. Lakshmanbhog and was lowest in Michrikanta. In the present investigation, the maximum percent of total soluble solids was in cv. Mallika of 23.60 and minimum of 12.80 in cv. Lakshmanbhog. The total sugar, reducing sugar as well as non-reducing sugar contents was maximum in cv. Mallika. The acidity of fruits varied from 0.15 –0.35%. The highest content of ascorbic acid was recorded in cv. Langra (56.34 mg / 100g). The highest TSS :Acid ratio was also recorded in the mango cvs. Mallika, Brindabani, Amrapali, Aswina, Gopalbhog, Rakhalbhog, Ashudagi and Kishanbhog. The highest and lowest amount of  $\beta$ -carotene was recorded in cv. Kishanbhog (17897  $\mu\text{g}/100\text{g}$ ) and cv. Brindabani (1089  $\mu\text{g}/100\text{g}$ ), respectively. The fruits of cv. Lakshmanbhog though contains lowest TSS:Acid as compared to Mallika (157.33), but have good attractive appearance, firm fruit, good keeping and transport quality, optimum size and shape, high fibreless edible proportion. The cv. Langra with high TSS : Acid (55.88) is one of the most popular cultivars of India. Thus, considering the fruit qualities, it was observed that some of the lesser known varieties viz. Michrikanta, Phunia, Ashudagi, Arajanna etc. have great potential for commercial exploitation. Also, regular bearing cultivar 'Laxhmanbhog' having good fruit quality and attractive colour could be a potent variety for export from the state.

### INTRODUCTION

Mango is an important fruit grown in India and other tropical and sub-tropical countries. In India, West Bengal state is known the choicest mango where it is mainly grown in the districts of Malda, Murshidabad, Nadia, and 24 Parganas (North). Malda being the leading district in area with highest production of mango in the state and also the district with the largest area dedicated to mango cultivation. None of the other districts of the State than Malda enjoys the benefits of the proximity to Bangladesh, the area is highly convenient and suitable as a hub of inter country mango trade between India and Bangladesh. Both domestic and export markets were probably not sufficiently supplied with the demanded quantity and quality of mangoes, but no doubted data on this are available.

Till a very recent time, the mango growers were not much concerned with the quality specifications of mango produced. The reasons for these were – i) the growers were not enough informed and hence were not aspiring for international markets other than Bangladesh, ii) the sanitary and phyto-sanitary measures (SPS) viz. GAP, EUREP etc. that have now been introduced in the international trade clauses, were not so stringent in the past, iii) the growers were very much concerned with immediate production rather than the sustainability of future productions i.e. they were not aware of the negative sides and evils of using pesticides and chemical fertilizers (Siddiqui and Dhua, 2010). Despite the still growing economic importance of mangoes in Malda, its potential has not yet been fully used and mango production struggles with several constraints along the whole value chain.

A large number of potentially good varieties have not yet been investigated. But a number of less known superior varieties still remain confined to the orchards of a few individuals only; as a result, these varieties are not gaining popularity. This work was, therefore, undertaken to collect information on the physico-chemical characteristics of the mango varieties grown in the district Malda. Many of these are less known in other part as well as in India. Some varieties are having excellent taste and unrivalled flavor with golden yellow colour. These qualities are having appealing attributes to merchants and consumers worldwide. The fruit is popular with masses due to its wide range of adaptability high nutritive value, richness in variety delicious taste and good flavor. For selecting the most suitable regular bearer (bear fruits every year), high producing cultivars in different subdivisions of Malda are essential. Besides most of our choice varieties of mango are biennial in their bearing habit (alternate bearing), low in productivity, poor in keeping and processing qualities and prone to various biotic and abiotic stresses which need urgent attention. Eighteen such promising types of mango from Malda district were identified for this study.

## MATERIALS AND METHODS

Promising eighteen cultivars such as Baishakhi Gooti, Gopalbhog, Lakshmanbhog, Kheersapati, Langra, Rakhlabhog, Golapphas, Ashudagi, Arajanna, Mallika, Amrapali, Krishnabhog, Michrikanta, Laxmibhog, Aswina, Fazli, Phunia and Brindabani were selected for the study. The fruits were collected from farmers field of eight mango growing Blocks of two Sub-division of Malda – MaldaSadar and Chanchal (situated at 25 m above mean sea level; the latitude and longitude being 24 40'20"N to 25 32'08"N and 87 45'50"E to 88 28'10"E respectively) West Bengal, India. The physico-chemical characterization of fruits was carried out in the laboratory of the Department of Horticulture, Institute of Agricultural Sciences, Calcutta University as well as Postharvest Technology Laboratory of Bidhan Chandra Krishi Viswavidyalaya for the 3 successive years from 2012 to 2014. Properly matured mango fruits were taken at random and were placed in bamboo baskets lined and covered with newspaper and stored at ambient condition for ripening. Sixty fruits were taken from each cultivar and then grouped into six lots containing 10 fruits in each.

Three (replicates) such lots were taken for the estimation of physical characters and the remaining 3(replicates) lots were taken for the estimation of chemical characters thus collected on the above qualitative and quantitative characters were analyzed as per one way analysis of variance with three observations per treatment (i.e. variety) and varietal effect were compared using LSD value at 5% level of significant (Gomez and Gomez, 1984).

Fruits were analyzed on attaining optimum ripe stage specific to different cultivar. Physical character of fruits were studied in respect of fruit weight, fruit size i.e. length, breadth, diameter and edible portion. The edible portion of different mango varieties was calculated from replicated fruits of each variety by subtracting the weight of peel and stone together from the weight of whole fruit. Chemical constituents like moisture, total soluble solid (TSS), total sugar (TS), reducing sugar (RS), non-reducing sugar (NRS), titratable acidity, ascorbic acid, TSS/ acid ratio and beta-carotene contents were estimated by following the standard procedure. The total soluble solid (TSS) content of mango pulp was estimated by using Abbe Refractometer. Total sugar was measured by anthrone method (Jayaraman, 1981). Reducing sugar content of mango pulp was determined by dinitrosalicylic acid method (Miller, 1972). Ascorbic acid content and titratable acidity were determined by visual titration method (Ranganna, 2000).

## RESULTS AND DISCUSSION

Except cv. Amrapali, the fruit bearing type of all other varieties were alternative i.e., these varieties of mango fruited once in two years. Among the eighteen studied varieties of mango only Fazli, Arajanna, Phunia and Aswina were late season cultivars whereas the fruits of the other cultivars mature at mid-season (Table 1). Bhuyan and Kobra (2007) found Begumphuli was the earliest and Malda was the latest in respect of harvesting time. Among the different mango cultivars studied in the present investigation, the fruits of Fazli, Mallika were superior to other cultivars with regard to fruit weight and size. The weight of fruits and their size were also higher in Langra, Lakshmanbhog, Kheersapati and Krishanbhog. The fruits of Amrapali, Golapphas, Gopalbhog, Baishakhi Gooti, Ashudagi, Arajanna, Laxmibhog and Brindabani were medium in weight and size while

Phunia was minimum in weight and smallest in size (Table 1). The variation in fruit length, fruit width and fruit diameter eighteen cultivars were also recorded. The longest fruit 12.5 cm was obtained from Fazli followed by Mallika, Krishanbhog and Lakshmanbhog and shortest fruit length of 6.1cm was obtained from Phunia. Fruit breadth of all the cultivars studied varied from 5.0-7.9 cm the maximum being in Fazli and minimum in Phunia while fruit diameter was highest in Fazli (7.1 cm) and minimum of 4.4 cm in Phunia.

The proportion of edible portion was the highest in cv. Lakshmanbhog (72.47%). Higher percentage edible portion were obtained from cvs. Kishanbhog (71.21%), Mallika (70.96%), Fazli (70.49%), Rakhalbhog (70.30%), Laxmibhog (69.51%) and Brindabani (69.0%). The mango cultivars Arajanma, Baishakhi Gooti, Gopalbhog, Kheershapati, Langra, Amrapali and Phunia had medium proportion of edible portion (62.22-68.98%). The lowest percentage of edible portion was in Michrikanta (52.54%) followed by Aswina (55.67%), Golapkhas (56.32%) and Ashudagi (57.03%). The weight of pulp excluding peel and stone was taken and percentage of edible portion was calculated on the basis of whole fruit. The

percentage of edible portion is an important factor for the evaluation of a cultivar in a particular locality because this is the part of the fruit which is utilized, that is the reason that Lakshmanbhog which weighed only 221g but reached at the top (72.47%) from percentage of edible portion point of view while Fazli weighted maximum (403g) showed 70.49 percent of edible portion. In an evaluation of sixty mango cultivars of Punjab, Bakshi and Bajwa (1959) recorded a variation of pulp from 62.6 to 78.4%, however, during the present study percentage of edible portion varied from a minimum of 52.54 percent in cv. Michrikantato 72.47 percent in Lakshmanbhog. The variation in this physical characteristic of mango fruit is natural due to differences in environmental and seasonal condition has also been observed earlier (Singh and Maurya, 1986; Badyal and Bhutani, 1989).

Among the eighteen cultivars of mango, the moisture content was maximum in Mallika (83.82%), followed by Aswina (83.02%), Ashudagi (81.60%), Michrikanta (80.30%), Fazli (81.24%), Langra (80.19%) and Kheeshapati (80.05%) while the fruits of Lakshmanbhog exhibited the lowest percentage of moisture (76.62%). The low moisture

**Table 1: Physical characteristic of fruits of different mango cultivars**

Name of variety	Date of harvest	Fruit weight (g)	Fruit size (cm)			Edible Portion (%)
			Length(cm)	Breadth (cm)	Diameter(cm)	
Amrapali	25 <sup>th</sup> June	120	8.9	7.0	6.4	68.98
Arajanma	30 <sup>th</sup> June	145	8.1	5.1	5.7	62.22
Ashudagi	12 <sup>th</sup> June	152	8.1	5.4	5.9	57.03
Aswina	20 <sup>th</sup> June	165	8.1	5.7	5.9	55.67
BaishakhiGooti	24 <sup>th</sup> May	159	8.1	5.1	5.7	63.10
Brindabani	04 <sup>th</sup> June	165	8.2	6.1	5.6	69.00
Fazli	30 <sup>th</sup> June	403	12.5	7.9	7.1	70.49
Golapkhas	02 <sup>nd</sup> June	120	8.1	5.1	5.8	56.32
Gopalbhog	27 <sup>th</sup> May	139	8.1	5.1	5.6	63.16
Kheershapati	5 <sup>th</sup> June	211	9.0	6.0	6.6	65.76
Krishanbhog	15 <sup>th</sup> June	210	10.0	6.8	7.0	71.21
Lakshmanbhog	13 <sup>th</sup> June	221	9.1	6.2	5.7	72.47
Langra	10 <sup>th</sup> June	230	9.0	6.0	6.7	65.16
Laxmibhog	15 <sup>th</sup> June	180	8.1	5.5	5.6	69.51
Mallika	25 <sup>th</sup> June	266	10.3	7.0	6.9	70.96
Michrikanta	12 <sup>th</sup> June	178	8.1	5.5	6.0	52.54
Phunia	30 <sup>th</sup> June	85	6.1	5.0	4.4	64.95
Rakhalbhog	20 <sup>th</sup> June	180	9.0	6.0	6.5	70.30
Mean		184	8.7	5.9	6.1	64.94
<b>SEm (±)</b>		9.24	0.43	0.29	0.30	3.25
<b>LSD (P=0.05)</b>		3.103	0.146	0.099	0.102	1.090

**Table 2: Bio-chemical characteristics of fruits of different mango cultivars**

Name of variety	Moisture (%)	TSS (°Brix)	Total Sugar (%)	Reducing Sugar (%)	Non Reducing Sugar (%)	Titrateable acidity (%)	Ascorbic acid (mg/100g)	TSS:Acid ratio	Beta-carotene (µg/100g)
Amrapali	78.41	19.00	17.50	4.78	12.72	0.15	22.61	126.67	17452
Arajanma	78.90	19.80	16.20	4.56	11.64	0.28	21.40	70.71	1187
Ashudagi	81.60	16.80	14.20	3.98	10.22	0.15	22.18	112.00	9768
Aswina	83.02	18.80	15.70	3.93	11.77	0.15	17.98	125.33	8965
BaishakhiGooti	79.80	13.50	10.70	3.96	6.74	0.21	22.52	64.28	9867
Brindabani	77.90	22.50	17.50	4.60	12.90	0.15	23.43	150.00	1089
Fazli	81.24	15.60	12.60	4.20	8.40	0.18	21.86	86.67	6512
Golapkhas	79.88	21.60	16.50	4.08	12.42	0.35	46.76	61.71	9564
Gopalbhog	77.70	18.70	15.60	4.32	11.28	0.15	18.87	124.67	11234
Kheersapati	80.05	16.20	14.50	4.06	10.44	0.24	15.76	67.50	10154
Kishanbhog	79.34	20.00	17.20	4.65	12.46	0.19	18.58	105.26	17897
Lakshmanbhog	76.62	12.80	10.25	3.94	6.31	0.32	23.46	40.00	11438
Langra	80.19	19.00	15.90	4.70	11.20	0.34	56.34	55.88	12365
Laxmibhog	77.80	16.40	11.90	3.60	8.30	0.28	43.68	58.57	10645
Mallika	83.82	23.60	18.30	4.89	13.41	0.15	46.88	157.33	15345
Michrikanta	80.30	19.00	16.60	4.34	12.26	0.25	19.65	76.00	12540
Phunia	78.90	20.20	16.70	4.57	12.13	0.30	38.52	67.33	9648
Rakhalbhog	79.05	18.00	14.70	3.90	10.80	0.15	18.96	120.00	8967
Mean	80.08	19.50	16.00	4.4	11.6	0.19	28.1	-	11121
SEm (±)	3.84	0.93	0.76	0.21	0.56	0.01	1.35	-	533
LSD (P=0.05)	1.232	0.299	0.246	0.068	0.178	0.003	0.433	-	171

content of the fruit of Lakshmanbhog is one of the causes of its good keeping quality. In the present investigation the maximum percent of total soluble solid was in cv. Mallika 23.60 % and minimum of 12.80% in cv. Lakshmanbhog. The TSS content of cultivars like Golapkhas, Arajanma, Kishanbhog, Phunia and Brindabani were appreciably high varied from 18.70-22.5%. Ghosh *et al.* (1985) also observed wide variation in TSS content of fruits and it varied 21.60 percent in Safdarpasand and 10.4 percent in Meghlanthan while Sanyal *et al.* (1991) recorded maximum (21.1 percent) TSS in cv. Dashehari and the minimum of 15.9 percent in the cv. Zardalu. Shyamal and Mishra (1987) reported the highest TSS in mango cvs. Fazli and Langra but during the present study no such higher values of TSS of fruits were noted. A considerable variation in sugar content among different cultivars was also observed. The range of variations in total sugar percent was 10.25 to 18.30 and the percent of reducing sugar content was 3.60 to 4.89, which was quite high. The percent of total sugar content reducing sugar as well as non-reducing sugar percent was maximum in cv. Mallika.

It is recorded higher values of non-reducing sugar than their respective reducing sugar contents and according to Kulkarni and Rameshwar (1981) reducing sugar was 43 percent sweeter than the non-reducing sugar and attributed the sweetness of a certain mango cultivars to its slightly higher reducing sugar content. Ghosh *et al.* (1985) observed minimum total sugar (6.20 percent) in cv. Meghlanthan and maximum (18.2 percent) in Safdarpasand while Sanyal *et al.* (1991) recorded a minimum of 14.19 percent total sugar in cv. Zardalu to 17.93 percent in cv. Dashier under west Bengal condition. The variation in the sugar contents of test mango cultivars were not in the line with earlier observation. This may be attributed to the seasonal variation as well as variation in the management practices of different orchards. The acidity of fruits varied from a minimum of 0.15 percent in the cvs. Gopalbhog, Rakhalbhog, Ashudagi, Mallika, Amrapali, Aswina and Brindabani to a maximum of 0.35 percent in Golapkhas. However, Ghosh *et al.* (1985) recorded maximum acidity of 0.32 percent in mango cvs. Bombay Yellow and Meghlanthan whereas minimum acidity in cv. Saradamonibhog. But

Banik *et al.* (1995) recorded maximum acidity of 0.35 percent in cv. Gulabkhas and minimum of 0.13 percent in cv. Meghlanthan.

The highest content of ascorbic acid was in cv. Langra (56.34 mm/100g) followed by Mallika, Golapkhas, Laxmibhog and Phunia. Kheersapati, Aswina, Kishanbhog, Gopalbhog, Arajanma, Fazli etc. had low content of ascorbic acid. Although mango is not a rich source of ascorbic acid but Langra showed maximum ascorbic acid content in the present study. Lodhet *al.* (1974) and Yadav *et al.* (1984) recorded increased ascorbic acid content in mango cv. Langra. Beta-carotene content was maximum in cv. Kishanbhog (17897 µg/100g) and minimum in cv. Brindabani (1089 µg/100g). The beta-carotene of all other cultivars ranged from 1187-17452 µg/100g. While studying the beta-carotene content of some mangoes grown in Nadia, Hooghly and 24-Parganas showed similar higher content of it in cvs. Biswanath Chatterjee and Amrapali (Sanyal *et al.*, 1991).

In the present study, it was recorded higher TSS: Acid ratio in the mango cvs. Mallika, Brindabani, Amrapali, Aswina, Gopalbhog, Rakhalbhog, Ashudagi and Kishanbhog as they had higher amount of TSS and less acidity compared to other cultivars. Similarly, low TSS content and high acidity adversely affected the TSS and Acid ratio in the cvs. Lakshmanbhog, Langra, Laxmibhog, Golapkhas, Baishakhi Gooti, Phunia, Kheersapati, Arajanma etc. The sweetness of the fruit is not only the factor which improves the quality. TSS comprises mainly the soluble sugar and fruit quality should be assessed with other characters and the acidity in particular. Again highly acidic fruits are not acceptable and there should be a balance between TSS and acid contents. Neither very high nor very low value of this ratio is good. So TSS and acid blending is an important factor for quality. The fruits of cv. Lakshmanbhog though contain low TSS: Acid (40.00) as compared to Mallika (157.33), but gained popularity in due to its good sugar / acid blending. On the other hand Langra which recorded TSS: Acid of 55.88, a good popular commercial cultivar of West Bengal as well as in India. Thus, considering the fruit qualities as noted above, some of the lesser known varieties viz. Michrikanta, Phunia, Ashudagi, Arajanma etc. have great potential for commercial exploitation. And as per the findings of Mitra *et al.* (2013) regular bearing cultivar 'Laxhman Bhog'

having good fruit quality and attractive colour could be a potent variety for export from the state.

## CONCLUSION

Characterization of available mango genetic resources is helpful for identification of suitable and promising cultivars for fresh consumption and/or storage. Wide variation in almost all the physico-chemical parameters was observed in eighteen cultivars of mango. Conclusively, it could be suggested that in addition to some popular cultivars, some other lesser known cultivars viz. Michrikanta, Phunia, Ashudagi, Arajanma etc. have great potential for commercial exploitation. Moreover, regular bearing cultivar 'Laxhmanbhog' having good fruit quality and attractive colour could be a potent variety for export from the state.

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