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Qualitative Analysis of Mango (*Mangifera indica*L.) Fruits at Physiological maturity

Indian.G[1], Deepika. V[2], Janani. T[3], Fahima Fathima[4]

Horticultural College and Research Institute, TNAU, Periyakulam-625604, Theni, Tamil Nadu, India

[1]M.Sc (Fruit science), Department of Fruit Crops, HC&RI (TNAU), Periyakulam, Tamilnadu, India.

[2]Ph.D (Fruit science), Department of Fruit Crops, HC&RI (TNAU), Coimbatore, Tamilnadu, India.

[3]M.Sc (Vegetable science), Department of Vegetable Crops, HC&RI (TNAU), Periyakulam, Tamilnadu, India

[4]M.Sc (Vegetable science), Department of Vegetable Crops, HC&RI (TNAU), Periyakulam, Tamilnadu, India

Abstract

The king of fruits "Mango" (*Mangiferaindica*L.) is very nutritious and rich in carotenes. India producesabout 50% of the total world's mango. Many researchershave reported the maturity indices and quality parametersfor determination of harvesting time and eating quality.Twenty seven diverse genotypes of mango were selected at central block, Horticultural College and Research Institute (TNAU), Periyakulam during August 2017–2018 May to analyze the quality parameters like total soluble solids, acidity, reducing sugar, non-reducing sugar, total sugar, ascorbic acid and total carotenoid content. The fruits were harvested at physiological maturity to determine the qualitative characters.The quality analysis revealed that the maximum TSS(20.12^0 Brix)and total sugar (19.47 %) was recorded significantly in Mohandhas. The maximum acidity (0.43 %), reducing sugar content (5.95 %), non-reducing sugar (14.71 %), total carotenoid content (15.79 mg/100g) and ascorbic acid content (53.76 mg/100 g) was recorded significantly in Pedharasam, KuruviNeelum, Banganapalli, Amarapali and Komangai respectively.

Keywords: Mango, genotypes, physiological maturity, Quality parameters.

Introduction

Mango (Mangiferaindica L.) is the mostimportant commercial fruit crop of the tropical and subtropical regions of the world. It is considered as the "king of fruits" due to its excellent flavour, beautiful colour, attractive fragrance and delicious taste.The ancient records mention the cultivation of mango in Indian subcontinent for well over 4000 years. One can also find in the mentions of travellers beginning from Hiun Tsang (632–645 AD) who was the fi rst foreigner to bring mango to the notice of world outside India (Bose and Mitra 2001). (1325–1349 AD) have written about the delicious fruit. Amir Khusrau, the great poet, praised the mango fruitduring the time of Mohammed Tughlaq. The greatest tributeto this fruit was paid by Emperor Akbar who established the *Lakh Bagh*(a mango orchard having 100,000 plants) in Darbhanga (Bihar) when large orchards of fruit trees were unknown. AbulFazl in *Ain-I-Akbari* has mentioned in detail the cultivars, cultivation and quality of mangoes (Bose andMitra 2001). It is a majorfruit crop of India and occupies an area of 2.263 million hectares with an annual production of 19.68 million tonnes and the productivity is 8.71 MT/hac. The export potential of India is 49658.67 MT of fresh fruits of mango with the benefit cost of Rs.40,021.34 Lacs.(APEDA, 2019-20) The area, production and productivity of mango in Tamilnadu is 1,58,198.86 hac, 5,46,174.93 MT and 3.45 MT/hac Respectively (TN Horticulture 2019-2020). There has been a growing demand for traditional varietiesof mango in Western markets. However, mangoes are yet to realize their maximum potential as an export oriented commodity due to their localized production and potential markets located across the globe. There are more than thousand mango varieties in India. However, only about 30 varieties are grown on commercial scale in different states.The quality parameters such as totalsoluble solids (TSS), acidity, reducing sugar, non-reducing sugar, total sugar, total carotenoid content and ascorbic acid content are important for the tablepurpose and value addition.

Materials and Methods

The experiment was conducted at Horticultural College and Research Institute (TNAU), Periyakulam duringAugust 2017–2018 May.The experiment was laid out in RBD design with three replications for quality analysis. The distance from plant to plant was 5.5 m and row to row was 5.5 m. Twenty seven mango genotypes were selected and the fruits are harvested at physiological maturity and the data were recorded on total soluble solids, acidity, reducing sugar, non-reducing sugar, total sugar, total carotenoid content and ascorbic acid content to determine the quality of the fruits. TSS was recorded with the help of hand refractometer.

Estimation of titrable acidity (%)

Titrable acidity was determined by titrating the sample extracted in water against 0.1N NaOH using phenolphthalein as indicator. The acidity was calculated by using the following formula and expressed in per cent (Ranganna, 1979).

$$\text{Titrable acidity (\%)} = \frac{1 \times \text{Equivalent weight of acid} \times \text{Normality of NaOH} \times \text{Titer value} \times 100}{10 \times \text{Weight of the sample}}$$

Estimation of reducing sugar (%)

Total reducing sugarcontent was determined by using Nelson reagent method. The reading of the sugar solution was measured at 510 nm absorbance on spectrophotometer for reducing sugar estimation (Bala*et al.*,2013). Total reducing sugars are expressed in per cent.

Estimation of non-reducing sugar(%)

The difference in the concentration of total sugar and reducing sugarwas taken as the concentration of non-reducing sugar. Non-reducing sugars was calculated by using the following formula and expressed in per cent.

Non-reducing sugarcontent (%) = Total soluble sugars – Reducing sugars

Estimation of total sugar (%)

Total sugar were determined by using Anthrone method. Sugar solution was extracted with ethanol and boiled for 10 minutes after adding anthrone reagent. The solution was cooled under running tap water and the reading was measured at 625 nmabsorbance on spectrophotometer (Bala*et al*., 2013). Total sugar was estimated by Somoigyi (1952) and the results were expressed in percentage.

Estimation of total carotenoid content (mg/100g)

Total carotenoid content was analyzed by using the method given by Roy (1973). The carotenoid pigments were extracted by taking a known quantity of the sample using mixture of petroleum ether and acetone in a ratio of 3:1. The known volume was made with the same petroleum ether and acetone mixture. The total carotenoid content was determined by taking OD at 450 nm using UV-VIS spectrophotometer (Double spectrophotometer UV-VIS Spectrophotometer UV 5704SS). The amount of total carotenoids was calculated using the following formula and expressed in (mg/100gm pulp).

$$\text{Total carotenoid content (mg/100gm pulp)} = \frac{3.87 \times \text{O.D. value} \times \text{final volume}}{\text{Weight of the sample}} \times 100$$

Estimation of ascorbic acid content (mg/100g)

Ascorbic acid content (Vitamin C) was determined by oxalic acid titration method(Ranganna, 1979). The juice was extracted with four per cent oxalic acid and the volume was made up to 100ml.Fromthis 5mi of extract was taken and titrated against 2,6 - dichloro indophenol dye. Ascorbic acid was calculated by using the following formula and expressed in mg $100g^{-1}$(Bala*et al.*, 2013).

$$\text{Ascorbic acid content (mg/100g)} = \frac{1\text{mg} \times \text{Vol. of dye used for standard} \times 100\text{ ml} \times 100\text{ g}}{\text{Vol. of dye used for sample} \times 5\text{ ml} \times \text{Weight of sample}}$$

The data were subjected to statistical scrutiny as applicable to randomized block design (RBD)which was analysed by GENRES (Statistical software programme).

Results and Discussion

TSS (^{0}Brix))

This character showed high range of mean performance value (14.58^{0}Brix -20.12 ^{0}Brix) with a general mean of 16.05 ^{0}Brix. Maximum TSS was recorded significantly in Mohandhas (20.12^0 Brix); whereas, minimum TSS was recorded in Komangai (14.58 ^{0}Brix)(Table 1).These findings are in line with Prem*et al.* (2012). Rodriguez *et al*. (2012) noticed that the highest acidity (0.22 %) was observed in cv. ValenciaPride, whereas cv. Lippens exhibited highest TSS (20.00 ^{0}Brix)

Acidity (%)

Acidity exhibited moderate range of variability (0.14-0.43 %) with a general mean of 0.22 %. The genotype Pedharasam recorded significantly maximum acidity (0.43 %) followed by Neelum (0.41 %) and Alphonso (0.36 %); whereas, Duraipandi recorded the lowest acidity (0.14 %) followed by Mohandhas (0.15 %) and PKM 1 (0.15 %)(Table 1).The variations in fruit acidity were also reported by Kumar (1998), Desai and Dhandar (2000), Mitra*et al.* (2001), Manna*et al*. (2003) and Akhtar *et al.*(2009) in different cultivars of mango.

Reducing sugar (%)

Wide range of variability was recorded for reducing sugar (3.04-5.95 %) with a general mean value of 3.63 %. Maximum reducing sugar content was observed significantly in KuruviNeelum (5.95 %) followed by ArkaAruna (5.75 %) and Alphonso (5.02 %); whereas, it was minimum in Javari (3.04 %) followed by Kovankachi (3.07 %) and Samba kooja (3.27 %)(Table 1).Variation in reducing sugar content in pulp was also recorded by Kabir*etal.* (2001), Chanana*et al.* (2005), Patil*et al.* (2011), and Ubwa*et al*. (2014) in different cultivars of mango.

Non reducing sugar (%)

Non-reducing sugar exhibited wide range of variability (9.74-14.71 %) with a general mean of 11.26 %. Among the genotypes, Banganapalli showed significantly maximum non reducing sugar (14.71 %) followed by KundurPacharisi (14.68 %) and SundarLangra (14.60 %), while ArkaAruna recorded minimum non-reducing sugar content (9.57 %) followed by Duraipandi (9.74 %) and Sindhu (10.37 %) (Table 1).These results are in accordance with the findings of Ubwa*et al*. (2014).

Total sugar (%)

Total sugar was recorded significantly maximum (19.47 %) in Mohandhas followed by Banganapalli (18.39 %), and Iswarya (18.38 %); whereas, minimum total sugar content was recorded in Duraipandi (13.6 %) followed by Au rumani (14.15 %) and Kovankachi (14.49 %). This character showed wide range of variability (13.6-19.47 %) with a general mean of 14.88 %(Table 1).The present result was partially confirming with the findings of Pawan and Chatterjee (2011) who recorded 15.77 % of maximum total sugar in cv. Zardalu. Similarly, Prem*etal.* (2012) recorded the total sugars in different varieties of mango.

Total carotenoid content (mg/100g)

Total carotenoid content exhibited wide range of variability (2.70 to 15.79 mg/100 g) with an average mean of 6.40 mg/100 g. Total carotenoid content was recorded significantly maximum (15.79 mg/100g) in Amarapali followed by Ratna (12.14 mg/100g) and Neelum (11.28 mg/100g); whereas, minimum total carotenoid content was recorded in Kundurpacharisi(2.7 mg/100g) followed by Duraipandi (3.04 mg/100g) and NathamPalamani (3.18 mg/100g)(Table 2). Total carotenoid contents provide an expression of natural appearance to the fruit product and higher content offer distinct advantage, particularly in international trade where addition of artificial colour is discouraged (Kalra*et al*., 1995). Present findings are in consonance with that of Sharma (1987), who observed that the total carotenoid contents content of varieties namely Amrapali and Malika exceeding their better parents.

Ascorbic acid content (mg/100g)

Ascorbic acid content varied significantly from genotype to genotype. Among the genotypes Komangai had the significantly maximum Ascorbic acid content (53.76 mg/100 g) which was higher followed by Samba kooja (51.36 mg/100g) and P.K.Patti (48.93 mg/100g), while Mohandhas had the lowest Ascorbic acid content (14.84 mg/100 g) followed by Pedharasam (25.30 mg/100g) and Iswarya (25.39 mg/100g)(Table 2).The variation in ascorbic acid content among mango cultivars is also reported by Rajwana*et al*. (2010).

Table 1.Mean performance of mango genotypes for quality characters

S.No.	Genotypes	TSS (^{0}Brix)	Acidity (%)	Reducing sugar (%)	Non-reducing sugar (%)	Total Sugar (%)
1	Alphonso	18.67*	0.36*	5.02*	11.00	16.02*
2	Amarapali	17.82*	0.34*	4.76*	11.81*	16.57*
3	ArkaAruna	18.69*	0.26*	5.75*	9.57	15.32
4	Au Rumani	18.64*	0.24*	3.43	10.72	14.15
5	Banganapalli	19.37*	0.23	3.68	14.71*	18.39*
6	Duraipandi	18.74*	0.14	3.86*	9.74	13.60
7	Iswarya	18.63*	0.27*	3.84*	14.54*	18.38*
8	Javari	18.47*	0.18	3.04	13.33*	16.37*
9	Komangai	14.58	0.27*	3.46	12.82*	16.28*
10	Kovankachi	17.23*	0.22	3.07	11.42	14.49
11	KundurPacharisi	18.79*	0.31*	3.42	14.68*	18.10*
12	KuruviNeelum	16.37	0.23	5.95*	11.26	17.21*
13	Mallika	18.48*	0.34*	4.04*	12.49*	16.53*
14	Malpacharisi	16.86*	0.16	4.15*	14.20*	18.35*
15	Mohandhas	20.12*	0.15	4.95*	14.57*	19.47*
16	NathamBalamani	17.26*	0.19	4.02*	11.07	15.09
17	Neelum	17.47*	0.41*	4.19*	11.19	15.38
18	P.K.Patti	15.76	0.18	3.53	12.14*	15.67*
19	Pedharasam	15.67	0.43*	4.32*	12.60*	16.92*
20	PKM 1	17.86*	0.15	3.28	13.45*	16.73*
21	PKM 2	18.60*	0.16	4.12*	13.26*	17.38*
22	Ratna	18.75*	0.24*	3.89*	13.56*	17.45*
23	Samba Kooja	16.54	0.17	3.27	12.48*	15.75*
24	Sendhuram	18.73	0.25*	4.17*	12.18*	16.35*
25	Shajahan	16.83	0.21	3.56	13.92*	17.48*
26	Sindhu	18.58	0.22	4.23*	10.37	14.60
27	SundarLangra	17.85	0.20	3.76	14.60*	18.36*
	Mean	16.05	0.22	3.63	11.26	14.88
	CD at 5%	0.74	0.05	0.16	0.46	0.61
	SE.m	0.26	0.04	0.06	0.16	0.21
	SE.d	0.37	0.02	0.08	0.23	0.30
	CV (%)	2.83	3.49	2.76	2.48	2.48

*-Significant at 5%

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Table 2.Mean performance of mango genotypes for quality characters

S.No.	Genotypes	Total carotenoid content (mg/100g)	Ascorbic acid content (mg/100g)
1	Alphonso	11.21*	37.04
2	Amarapali	15.79*	37.91*
3	ArkaAruna	7.12*	42.78*
4	Au Rumani	3.65	38.62*
5	Banganapalli	7.64*	48.82*
6	Duraipandi	3.04	40.03*
7	Iswarya	8.16*	25.39
8	Javari	6.89*	41.26*
9	Komangai	4.44	53.76*
10	Kovankachi	8.89*	39.85*
11	KundurPacharisi	2.70	42.48*
12	KuruviNeelum	3.61	47.38*
13	Mallika	4.40	47.06*
14	Malpacharisi	6.06	28.49
15	Mohandhas	5.72	14.84
16	NathamBalamani	3.18	47.28*
17	Neelum	11.28*	38.63*
18	P.K.Patti	3.67	48.93*
19	Pedharasam	5.87	25.30
20	PKM 1	9.36*	27.39
21	PKM 2	8.35*	38.47*
22	Ratna	12.14*	40.04*
23	Samba Kooja	4.08	51.36*
24	Sendhuram	10.37*	35.28
25	Shajahan	9.47*	46.38*
26	Sindhu	7.56*	38.28*
27	SundarLangra	7.43*	51.25*
	Mean	6.40	35.81
	CD at 5%	0.28	1.77
	SE.m	0.10	0.63
	SE.d	0.14	0.88
	CV (%)	2.68	3.02

*-Significant at 5%

Conclusion

The study revealed thatthe maximum TSS(20.12^0 Brix) and total sugar (19.47 %) was recorded significantly in Mohandhas followed by Banganapalli, KundurPacharisi, Ratna and Duraipandi. It was concluded that the fruit of Mohandhas,Banganapalli, KundurPacharisi, Ratna and Duraipandican be used for the tablepurpose and value addition.

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