



E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(3): 4435-4438
Received: 16-03-2019
Accepted: 18-04-2019

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Performance of some south Indian mango cultivars under *Tarai* condition of Uttarakhand

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Abstract

Fifteen south Indian mango cultivars were studied for their performance at Horticultural Research Centre, Patharchatta during 2016 to 2017. The fruit yield ranged from 5.17 kg/m² (Bangalora) to 0.47 kg/m² (Cecil). Dadha Peda, Krutha Kolamban, Mulgoa, Neelum, Royal Special and Totapuri Red Small were found to be good croppers. Maximum weight, volume and length were recorded in cv. Nariyal while fruit length of Karutha Kolamban was maximum. Pathre had maximum pulp and minimum stone content and Karutha Kolamban had the least peel content. The pulp: stone ratio was the highest in Pathre. Analytical results of mature fruits revealed a wide variation in TSS, total sugars, acidity, ascorbic acid and carotene content. Chemical analysis of ripe fruits showed maximum TSS and minimum acidity in cv. Kalank Goa, whereas the highest total sugars was recorded in Dadha Peda. The reducing sugar content varied from 2.36% in Royal Special to 6.54% in Dadha Peda and non-reducing sugar content varied from 3.89% in Cecil to 11.46% in Dadha Peda. Maximum carotene was observed in Royal Special, Neelum showed minimum fibre content. Ascorbic acid was maximum in Makram while it was minimum in Royal Special. On the basis of organoleptic test Bangalora scored maximum point.

Keywords: Mango, south Indian cultivars, performance, yield, quality

Introduction

India is the largest producer of mango in the world yielding around 19.51 million tonnes and with productivity of 8.8 t/ha (Anonymous, 2017) [2]. There are about 1000 mango varieties in India, but only 25 are cultivated on a commercial scale. The characteristics of each variety vary widely at different places. Though physico-chemical analysis of different mango varieties had been reported by different workers (Bakshi *et al.*, 2013; Bora *et al.*, 2015; Singh *et al.*, 2017) [4, 5, 12] from different parts of the country, but no such work has been reported from *Tarai* region of Uttarakhand. Keeping these points in view, the present investigation was carried out with 15 south Indian mango cultivars under *Tarai* condition of Uttarakhand.

Materials and Methods

The trial was conducted at Horticultural Research Centre, Patharchatta during 2015 to 2017 with 15 south Indian mango cultivars. Total yield per tree was recorded by weighing the fruits at the time of harvest and presented as kg per square meter canopy area by the yield of tree with its canopy area. For physico-chemical analysis, twenty five fruits of each cultivar were randomly picked and these fruits were analyzed for physico-chemical characters at harvest at full ripe stage. Fruit weight, volume, size, pulp, peel and stone per cent were recorded. The total soluble solids (TSS) of the fruits was estimated with the help of a hand refractometer and expressed as percentage. Acidity was determined by titrating the fruit juice against N/10 NaOH solution. Reducing, non-reducing and total sugars, ascorbic acid and carotene were determined (AOAC, 1980) [3]. Crude fibre content was estimated through sensory evaluation performed by a panel of 5 judges who scored it on a 9 point hedonic scale (Amerine *et al.*, 1965) [1].

Results and Discussion

Yield

A perusal of Table 1 reveals that fruit yield was maximum in Bangalora followed by Dadha Peda and Karutha Kolamban. However Cecil, Pathre, Naspati and Makram yielded very low. Dangi *et al.* (2017) [6] also reported a significant variation in yield of different mango cultivars. The variation in yield of the cultivars might be due to the inherent variation in the absorption and translocation capacity of various cultivars for nutrients from soil, distributing within plant

system; synthesis and translocation of photosynthates and plant hormones; fruit set, fruit drop, tree size and leaf area.

Fruit weight, volume, size and specific gravity

Considerable variation was observed in fruit weight, volume, length, width and specific gravity. The fruit weight, volume and width were maximum in Nariyal while fruit length of Karutha Kolamban was maximum. However, fruit weight and volume of Goa Mankur was minimum. Fruit length was less than 9.00cm in cvs. Cecil, Dadha Peda, Goa Mankur, Naspati, Neelum. Whereas, fruit width of cvs. Dadha Peda, Goa Mankur, Mulgoa and Totapari Red small was less than 6.00cm. Specific gravity of these cultivars varied from 0.915 to 1.100 at harvest with minimum in Royal Special and maximum in Dadha Peda. The variation among physical characters of mango cultivars might be due to variation in genetic constitution and interaction of various genotypes with agroclimatic conditions.

Pulp, peel, stone content and pulp: stone ratio

The pulp, peel and stone contents of fruit impart the quality of the fruit. Peel and stone are the non-edible part of the fruit and so pulp per cent is the main characters which justify its importance as commercial cultivar to a particular region. A great variation in pulp, peel and stone contents was observed (Table 1). A range of 62.73% pulp in cv. Goa Mankur to 79.58% pulp in cv. Pathre was recorded. Minimum peel per cent (10.30) was noted in Pathre. The pulp: stone ratio was the highest in Pathre. The recovery of pulp is a varietal character. That's why whatever cultivars had the fruit size the per cent of pulp remained almost same.

Total Soluble Solids and Sugars

TSS of the fruit juice gives a rough idea of sweetness. It is evident from the data presented in Table 2 and 3 that TSS and total sugars of fruit at harvest ranged from 5.66 to 12.20% and 3.66 to 7.45%, respectively. However, these values were found in the range of 13.80 to 20.78% and 8.09 to 18.00%, respectively at full ripe stage. Maximum TSS was recorded in cv. Kalank Goa followed by Mulgoa and Dadha Peda at full ripe stage. Makram had the least TSS. However, total sugars were maximum in Dadha Peda and minimum in Makram. The reducing sugar content varied from 2.36 in Royal Special to 6.54% in Dadha Peda and non-reducing sugar content varied from 3.89% in Cecil to 11.46% in Dadha Peda at full ripe stage.

The TSS and sugars of the fruits are genetical characters which might be affected by harvesting date of fruits. If the fruits are not harvesting at right stage of maturity, proper ripening does not take place and thus conversion of starch, acid and other insoluble substances into soluble form also does not take place properly, resulting in reduced TSS and sugars. It is also clear from the data presented in Tables 2 and 3 that TSS and total sugars were almost doubled during the process of ripening at ambient temperature. The increase in TSS and sugars can be attributed to conversion of starch into sugars and the sugars may accumulate in the fruits due to high rate of enzymatic activity as compared with the rate of utilization in respiration (Elsheshetawy *et al.*, 2016)^[7].

Acidity

The minimum value of acidity was recorded in Kalank Goa while it was maximum in Makram at full ripe stage (Table 3).

At harvest, acidity range from 0.545 to 1.635%, with minimum in Dadha Peda and maximum in Totapuri Red Small (Table 2). Acidity is a varietal character. That is why, fully matured and ripened fruits of Makram, Cecil, Mulgoa, etc. showed such high acidity. The retention of more acids in mature fruits might be due to the incomplete conversion of acids to sugars. During the process of ripening many acids convert into sugars resulting decrease in acidity (Kumar *et al.*, 1992)^[9].

Ascorbic acid

Data (Table 2 and Table 3) revealed that ascorbic acid range from 20.22 mg/100g in Royal Special to 105.00 mg/100g pulp in Makram at harvest. However, ascorbic acid content reduced to 11.26 mg/100g in Royal Special 85.50 mg/100g in Makram at full ripe stage. Similar variation in ascorbic acid content was reported by Modesto *et al.* (2016)^[10]. Data also show that ascorbic acid decreased in the process of ripening in all the cultivars. This might be due to oxidation of ascorbic acid.

Carotene content

A perusal of Table 2 revealed that carotene content of south Indian cultivars ranged from 0.065 mg to 1.56 mg/100 g pulp at harvest with minimum in Bangalora and maximum in Neelum. However, carotene content ranged from 0.58 mg to 4.96 mg/100g pulp at full ripe stage (Table 3). Highest carotene content was observed in cv. Royal Special followed by Dadha Peda and Neelum, while least was observed in cv. Makram. According to Singh (2002)^[13], mango cultivars differ significantly from one another in respect of carotene content due to difference in genetical make up of cultivars and also because of difference in their fruit development period and ripening season.

Crude fibre

The range of crude fibre was 0.45 to 3.45% (Table 3). The minimum crude fibre was noted in cv. Neelum followed by Makram and Nariyal. However, cv. Royal Special showed maximum crude fibre. Sucking type of mango had more amount of crude fibre as compared to table cultivars.

Organoleptic rating

On the basis of organoleptic tests, cvs. Bangalora, Dadha Peda, Mulgoa, Neelum, Pathre, Karutha Kolamban, Rajapuri and Royal Special scored more than 5.50 points and had acceptable quality fruits, whereas, remaining cultivars scored less than 5.50 points and did not have acceptable quality fruits. The significant variation in organoleptic quality as reported in the present study was also obtained by other mango researchers (Joshi, 2010; Pawar, 2011)^[8, 11]. It appears that these cultivars required high temperature and humidity prevailing in southern parts of India but can be grown in *Tarai* region.

Conclusion

These results conclude that Bangalora, Dadha Peda, Karutha Kolamban, Mulgoa and Neelum were good cultivars for fruit yield and quality and thus, can be successfully grown under *Tarai* conditions of Uttarakhand.

Table 1: Physical characters of south Indian mango cultivars at harvest stage under *Tarai* condition (Pooled data of year 2016 and 2017)

Name of cultivars	Yield (kg/m ²)	Fruit weight (g)	Volume (ml)	Specific gravity	Length (cm)	Width (cm)	Pulp (%)	Peel (%)	Stone (%)	Pulp: stone ratio
Bangalora	5.17	213.55	211.43	1.010	10.54	6.30	76.00	14.78	9.22	8.24
Cecil	0.47	136.40	139.00	0.981	7.90	6.30	66.84	15.02	18.14	3.68
Dadha Peda	3.47	134.67	122.39	1.100	6.98	5.94	73.98	13.96	12.06	6.13
Goa Mankur	1.51	101.92	97.00	1.050	7.38	5.44	62.73	18.39	18.88	3.32
Kalank Goa	1.48	239.90	231.00	1.038	11.66	6.88	71.15	13.66	15.19	4.68
Karutha Kolamban	2.92	299.50	303.00	0.988	13.52	6.50	77.46	10.30	12.24	6.33
Makram	0.93	323.50	315.41	1.025	12.48	7.64	72.38	15.09	12.53	5.78
Mulgoa	2.29	165.50	160.95	1.028	9.46	5.92	73.50	12.17	14.33	5.13
Nariyal	1.09	414.66	405.66	1.022	12.70	9.22	72.70	14.07	13.23	5.50
Naspati	0.67	205.75	203.60	1.010	8.10	7.28	72.39	16.17	11.44	6.33
Neelum	2.35	138.38	134.60	1.025	8.44	6.46	68.31	18.01	13.68	5.00
Pathre	0.60	314.38	317.45	0.990	11.30	8.08	79.58	11.57	8.85	9.00
Rajapuri	1.25	225.50	224.40	0.004	9.76	7.12	68.19	21.19	10.62	6.42
Royal Special	2.86	194.31	212.20	0.915	10.06	6.10	73.64	15.54	10.82	6.81
Totapari Red Small	2.55	142.00	145.00	0.979	9.94	5.84	59.68	18.76	21.56	2.77
SE(m).±	0.392	9.17	9.04	.0048	0.189	0.109	0.662	0.349	0.392	0.184
C.D. at 5%	1.10	25.76	25.39	0.013	0.53	0.31	1.86	0.98	1.10	0.52

Table 2: Chemical composition of south Indian mango cultivars at harvest under *Tarai* condition (Pooled data of year 2016 and 2017)

Name of cultivars	TSS (%)	Reducing sugars (%)	Non-reducing sugars (%)	Total Sugar (%)	Acidity (%)	Ascorbic acid (mg/100g)	Carotene (mg/100g)
Bangalora	8.20	1.34	3.23	4.57	1.225	24.20	0.065
Cecil	6.75	1.87	1.95	3.82	0.985	81.00	0.15
Dadha Peda	11.00	4.15	3.30	7.45	0.545	27.14	0.93
Goa Mankur	8.00	1.66	3.79	5.45	1.050	47.70	0.25
Kalank Goa	11.50	2.44	2.78	5.22	0.835	22.25	0.20
Karutha Kolamban	6.88	1.50	3.19	4.69	1.012	92.35	.011
Makram	5.66	1.50	2.16	3.66	1.625	105.00	.013
Mulgoa	12.20	2.44	2.78	5.22	1.185	26.33	0.58
Nariyal	8.88	3.26	2.03	5.29	1.333	38.25	0.88
Naspati	9.80	1.66	3.20	4.86	1.380	42.15	0.93
Neelum	6.75	3.14	3.62	6.76	0.860	80.33	1.56
Pathre	10.30	2.92	4.30	7.22	1.245	57.24	1.01
Rajapuri	10.30	2.66	2.34	5.00	1.220	25.50	1.08
Royal Special	6.88	1.42	4.41	5.83	1.185	20.22	1.03
Totapari Red Small	5.90	1.69	2.51	4.20	1.635	72.40	1.12
SE(m).±	0.206	0.076	0.097	0.128	0.037	2.89	0.118
C.D. at 5%	0.58	0.21	0.27	0.36	0.10	8.12	0.33

Table 3: Chemical composition of south Indian mango cultivars at full ripe stage under *Tarai* condition (Pooled data of year 2016 and 2017)

Name of cultivars	TSS (%)	Reducing sugars (%)	Non-reducing sugars (%)	Total Sugar (%)	Acidity (%)	Ascorbic acid (mg/100g)	Carotene (mg/100g)	Fibre (%)	Organoleptic score (out of 9.00)
Bangalora	19.38	3.23	7.62	10.85	0.200	15.80	0.72	1.70	6.40
Cecil	15.85	5.30	3.89	9.19	0.385	62.75	1.06	3.25	3.80
Dadha Peda	50.60	6.54	11.46	18.00	0.155	21.20	4.33	0.84	6.00
Goa Mankur	16.15	3.84	7.16	11.00	0.290	26.18	1.73	2.18	3.40
Kalank Goa	20.78	6.00	8.00	14.00	0.190	16.66	1.66	2.30	5.80
Karutha Kolamban	16.50	2.88	7.78	10.60	0.333	63.40	1.81	0.85	5.80
Makram	13.80	3.22	4.87	8.09	0.459	85.50	0.58	0.55	3.60
Mulgoa	20.66	2.86	8.55	11.41	0.380	18.59	1.63	2.22	6.00
Nariyal	18.55	5.23	5.29	10.52	0.325	28.66	3.95	0.75	4.20
Naspati	17.75	5.75	5.31	11.06	0.333	28.11	2.54	2.30	5.00
Neelum	18.33	6.24	10.20	16.44	0.265	40.00	4.27	0.45	5.80
Pathre	20.50	4.68	10.08	14.76	0.295	45.45	2.78	2.00	6.00
Rajapuri	16.60	5.85	4.44	10.29	0.275	16.80	3.66	1.98	5.60
Royal Special	15.55	2.36	2.36	10.98	0.225	11.26	1.96	3.45	5.60
Totapari Red Small	14.60	3.33	3.33	11.39	0.300	60.80	3.22	3.10	5.00
S.Em.±	0.233	0.137	0.289	0.240	0.024	2.29	0.226	0.102	0.205
C.D. at 5%	0.65	0.38	0.67	0.81	0.06	6.43	0.75	0.29	0.37

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