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Evaluation of mango varieties for pulp processing suitability

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Abstract

Thirty mango varieties were evaluated for pulp processing suitability. Fruit weight of mango varieties ranged from 122.67 to 583.34 g (CV =10.02%), measured maximum for Sonia Malda (583.34 g) followed by Malda (572.34 g) and minimum fruit weight was noticed in Gourjeet (122.67 g). Pulp percentage varied from 53.96 to 75.28%, observed maximum in Sonia Malda (75.28%) followed by Malda (74.11%) and minimum pulp content was recorded in Gourjeet (52.85%) trailed by Cylone (53.96%). Sonia Malda (75.28%), Malda (74.11%), Mallika (72.00%) and Hybrid 18-8 (72.47%) were possessed more than 70% pulp content while 7 varieties (Amin Tehsilwala, Benzeer, Bombay Bottle, Creeping, Kharuspatti, Amrapali and Nisar Pasand) had pulp percentage between 65-70%. The stone percentage was considerably differed in mango genotypes (CV=10.03%) and varied from 10.97 to 21.71%; maximum in Mithua and minimum in Mallika. Similarly, peel percentage ranged from 11.32 to 19.56%, minimum was observed in Sonia Malda (11.32%) followed by Malda (11.76%), Bombay Bottle (11.90%) and Amin Tehsilwala (11.77%) and maximum peel per cent was reported in Gourjeet (19.56%), Santra (19.23%) and Himsagar (18.73%). The varieties having high pulp content also showed high pulp/stone ratio and pulp/peel ratio. The highest pulp/stone ratio was noticed in Mallika (6.56), Malda (6.18) and Sonia Malda (5.37) and lowest was found in Gourjeet (2.09). Pulp TSS of most of the varieties was recorded between 15-20ºBrix which was in line with the mango pulp industry standards (16ºBrix). Maximum pulp TSS was observed in Amrapali (20.83ºBrix) followed by Bombay (20.80ºBrix), Mallika and Nisar Pasand (20.50ºBrix) and Dashehari (20.13ºBrix) while minimum TSS was noticed in Shere-a-Hayat (12.90ºBrix) followed by Kalapahar (13.96ºBrix). Based on pulp quantity it may be concluded that; Malda, Sonia Malda, Mallika, Hybrid 18-8, Amin Tehsilwala, Benzeer, Creeping, Kharuspatti, Amrapali, Dashehari, Nisar Pasand and Bombay Bottle were found suitable for pulp processing.

Key words: Mango, pulp, evaluation, processing suitability, heirloom varieties

Introduction

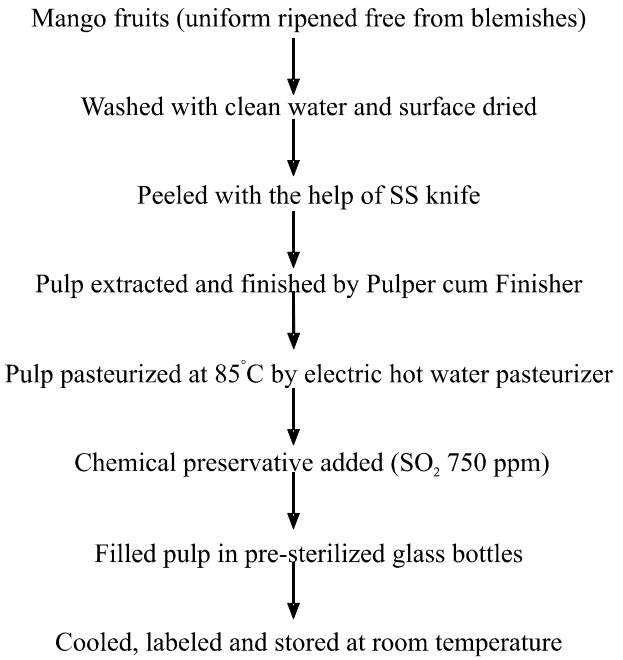
India habours more than 1000 mango varieties/landraces in different agro-ecological regions and represents the largest mango germplasm in the world (Singh *et al*., 2012). Mango has been cultivated and conserved in different agro-ecological regions including Malihabad area of Lucknow-Saharanpur mango belt of the country (Prakash and Dinesh, 2007). This region is known for old mango plantations predominantly originated from seedling population which were established naturally or propagated through selected stones from elite indigenous mango plants on the basis of fruit quality characteristics and maintained by local fruit lovers since decades. Traditional mango varieties of Malihabad are recognized for their unique characteristics and many of them have originated as open pollinated seedlings from the varieties introduced from different parts of country as, well as, selection of superior seedlings (Ram and Rajan, 2003).

Heirloom varieties are defined as local or regional varieties, passed down from generation to generation of gardeners/farmers, maintained by asexual means, also include old commercial varieties/antiques, presently not grown on commercial scale and limited to few in orchards. Pre-occupation of the agricultural research sector, mango growers and market sector, which are mainly concerned with few established commercial varieties might overlook and underestimate the potential of heirloom varieties (Rajan *et al*., 2014). Rapid loss of diversity due to urbanization, industrialization and resultant felling of trees has been well documented (Khan *et al*., 2015), highlighting the need for collection, conservation and evaluation of processing suitability of non-commercial, heirloom varieties. Mango fruits are used as dessert as a table fruit and are also processed into pulp. Mango pulp is the basic material for preparation of number of other mango based value added products such as juice, squash, RTS, nectar, jam, ice cream, *etc*. The demand for mango fruits and its pulp in the country and abroad is continuously increasing over the years. On farm conservation of these varieties can be encouraged through making economic use of fruits of such varieties. Non commercial, heirloom varieties may be used for pulp processing and other value added product development for additional income generation to the custodian farmers. Therefore, present study was carried out to screen the heirloom and some commercial varieties of Malihabd region for pulp processing suitability.

Materials and Methods

The fruits of 30 heirloom and commercial mango

varieties (Amin Tehsilwala, Amrapali, Benzeer, Benzeer Sandila, Bombay, Bombay Bottle, Creeping, Cylone, Dashehari, Digambar, Eldon, Gourjeet, Gulab Khas, Himsagar, Hybrid 18-8, Inayat Pasand, Kala Pahar, Kharus Patti, Kichnar, Kohitoor, Madhavrao Pasand, Malda, Mallika, Mithua, Nisar Pasand, Santra, Sharda Bhog, Sherehayat, Sonia Malda and Surkha Verma) were procured from the mango field gene bank of ICAR-Central Institute for Subtropical Horticulture, Rehmankhera, Lucknow and farmers field. After fruit ripening pulp was extracted through electric pulper cum finisher machine and pasteurized by electric pasteurizer. Complete process of pulp extraction is given in flowchart below.



Average fruit weight was measured by electronic balance and fruit peel thickness was measured by electronic vernier caliper. Total soluble solids (TSS) of pulp was recorded by using ERMA hand refractometer and reading were expressed as degree Brix (°B). The titrable acidity of fruit pulp was estimated by titrating it against 0.1N sodium hydroxide (NaOH) solution using phenolphthalein as an indicator (A.O.A.C., 1984). Ascorbic acid in pulp is estimated by visual titrimetric method using 2,6-dichlorophenol indophenols dye solution as indicator (Rangana, 1986). Pulp, stone, peel and fibre percentage was measured by using standard formulas.

Results and Discussion

Thirty varieties were evaluated for their physical attributes and parameters pertaining to processing suitability (Table 1). Fruit weight ranged from 122.67 g to 583.34 g (CV =10.02%). The maximum fruit weight was noted in Sonia Malda (583.34 g) followed by Malda (572.34 g) and minimum fruit weight was observed in Gourjeet (122.67 g). Mango varieties also showed considerable variation with respect to peel thickness and showed maximum variation (CV=19.15%) among all the characters studied. Wide variation was recorded with respect to peel thickness which varied from 1.10 to 2.40 mm. The lowest peel thickness was reported in Madhavrao Pasand (1.10 mm) followed by Amrapali (1.40 mm) and thickest peel was noticed in Banzeer Sandila (2.40 mm) followed by Amin Tehsilwla (2.37 mm). Sharma (2007) evaluated sucking types mangoes under sub mountane zone of eastern Punjab conditions and reported a wide variation in respect of fruit shape, size and weight. Kishore *et al.* (2015) also observed more than 400 g fruit weight in Alfazli, Arka Anmol, Neeluddin and Totapari, whereas Dashehari, Prabha Sankar, AU Rumani and Arunika had small fruits of less than 200 g grown under eastern coast conditions of India.

Pulp percentage is extremely important character with respect to suitability of mango variety for processing and value addition. High pulp yield is crucial for functioning of mango pulp industry in sustainable and economical manner. Substantial variation (CV=3.34%) was reported among mango varieties with respect to pulp quantity. The pulp percentage varied from 53.96 to 75.28%. The highest pulp percentage was measured in Sonia Malda (75.28%) followed by Malda (74.11%) and minimum pulp quantity was recorded in Gourjeet (52.85%) trailed by Cylone (53.96%) (Table 1). Low pulp content was also reported in Gourjeet and Mithua by previous workers (Pandey *et al.,* 2018). Four varieties namely; Sonia Malda (75.28%), Malda (74.11%), Mallika (72.00%) and Hybrid 18-8 (72.47%) were possessed more than 70% pulp content while 7 varieties (Amin Tehsilwala, Benzeer, Bombay Bottle, Creeping, Kharauspati, Amrapali and Nisar Pasand) having pulp percentage between 65-70%. Therefore, these varieties may be considered suitable for pulp processing and further value addition of pulp. The pulp percentage of mango varieties varied with the climatic conditions, fruit size and horticulture practices during production (Anil and Radha, 2003; Padhiar *et al*., 2011). High pulp content and pulp/stone ratio was also recorded in Langra, Mallika, Pusa Arunima and Pusa Surya by Kishore *et al.* (2015).

The stone percentage was also considerably differed in mango genotypes (CV=10.03%) and varied from 10.97 to 21.71%; being maximum in Mithua and minimum in Mallika (Table 1). Significant variation (CV=9.87%) was found in mango genotypes with respect to peel per cent and it ranged from 11.32 to 19.56%. The lowest peel percentage was found in Sonia Malda (11.32%), Malda (11.76%), Bombay Bottle (11.90%) and Amin Tehsilwala (11.77%) and maximum peel percentage was reported in Gourjeet (19.56%), Santra (19.23%) and Himsagar (18.73%). Fibre content in mango pulp is also an important attribute with regard to processing suitability of mango variety. Presence of fibers are a necessity to protect the interior of a fruit from bruising and internal collapse during handling and shipping, however, abundance of fibre content are not suitable for processing purpose and reduce the consumer acceptability (Iyer, 1991). Noteworthy disparity was observed among mango genotypes with respect to fibre percentage. Fibre percentage in pulp ranged from 1.14 to 3.77%. The lowest fibre content was measured in Benzeer (1.14%), Kichnar (1.20%) Amrapali (1.24%) and Dashehari

(1.48%) and maximum fibre (%) was found in Eldon (3.77%) and Creeping (3.52%). Ara *et al.* (2014) found significant variation in fibre content in mango varieties grown in Bangladesh. They found maximum amount of fibre in Langra (4.78 g/100 g) followed by Khirsapat (3.16 g/100 g) and Himsagar (2.72 g/100g). Lowest amount of crude fiber was found in Guti (1.08 g/100 g). The varieties having high pulp content were also showed high pulp/stone ratio. The highest pulp/stone ratio was noticed in Mallika (6.56), Malda (6.18) and Sonia Malda (5.37) and lowest was found in Gourjeet (2.09). Same trend was observed among mango varieties in case of pulp/peel ratio.

Evaluation of biochemical parameters revealed that mango genotypes possessed wide variability with respect to total soluble solids (TSS), titrable acidity, ascorbic acid and TSS/acid ratio. The highest total soluble solids in pulp were observed in Amrapali (20.83ºBrix), Bombay (20.80 ºBrix), Mallika, Nisar Pasand (20.50ºBrix) and Dashehari (20.13ºBrix) while minimum TSS were noticed in Shere-a-Hayat (12.90ºBrix) followed by Kalapahar (13.96ºBrix) (Table 2). Pulp TSS of most of the varieties was recorded between 15-20 ºBrix which was in line with the mango pulp industry standard (16ºBrix). TSS of the 31 north Kerala mango genotypes ranged between 12.7 and 25.2 °brix and 'Heralappa'(25.2° brix) and 'Kalapady' (24.7°Brix) were the two top genotypes in this respect (Pradeepkumar *et al*., 2006). TSS/acid ratio was also considerably differed (CV=10%) among mango genotypes and ranged between 10.16 to 65.91. The highest TSS/acid blend was observed in Amrapali (65.91) and lowest was found in Shere-a-Hayat. TSS/acid ratio more than 45 was observed in Amrapali, Dashehari and Nisar Pasand while less than 15 were noticed in Shere-a-Hayat, Shardabhog, Madhavrao Pasand and Kalapahar (Table 2). Kishore *et al.* (2015) also reported high TSS (21.9°Brix) and TSS/acid ratio (72.3) in Amrapali mango pulp. Significant variation (CV=10.68%) was recorded for pulp titrable acidity (%) among mango genotypes and it was ranged from 0.31 to 1.31%. Maximum acidity was witnessed in Madhavrao Pasand (1.31%) followed by Shere-a-Hayat (1.29%), Shardabhog (1.07%) and Kalapahar (1.03%) and minimum acidity were found in commercial varieties such as Amrapali (0.42%), Dashehari (0.43%) and in Gourjeet (0.49%), a

Table 1. Physical attributes and pulp per cent of some commercial and heirloom mango varieties

Variety	Fruit weight (g)	Peel thickness (mm)	Pulp (%)	Stone (%)	Peel (%)	Fibre (%)	Pulp/ stone ratio	Pulp/ peel ratio
Amin Tehsilwala	349.67	2.37	69.70	16.26	11.77	2.35	4.28	5.92
Amrapali	138.34	1.30	65.45	19.76	13.53	1.24	3.31	5.22
Benzeer	383.00	1.40	66.86	16.46	15.53	1.14	4.06	4.30
Benzeer Sandila	236.34	2.43	64.58	18.50	14.53	2.35	3.49	4.44
Bombay	190.67	1.80	58.39	15.53	18.10	1.98	3.75	3.22
Bombay Bottle	314.33	2.13	69.27	15.76	11.90	2.94	4.39	5.82
Creeping	291.35	2.10	66.30	13.52	16.66	3.52	4.90	3.97
Cylone	186.34	1.76	53.96	17.40	18.46	2.49	3.10	2.92
Dashehari	200.39	1.43	64.13	16.30	18.03	1.48	3.93	3.55
Digambar	192.53	1.93	57.30	21.33	19.10	3.11	2.81	3.35
Eldon	225.67	2.26	60.83	21.00	17.20	3.77	2.89	3.53
Gourjeet	122.67	1.66	52.85	25.20	19.56	2.46	2.09	2.70
Gulab Khas	211.25	1.53	57.69	23.03	17.38	1.86	2.50	3.31
Himsagar	225.00	2.16	59.19	20.60	18.73	1.37	2.87	3.15
Hybrid 18-8	283.41	1.50	72.47	12.76	12.76	1.91	5.67	5.67
Inayat Pasand	204.34	1.70	62.31	18.16	17.46	2.03	3.42	3.56
KalaPahar	193.00	1.43	63.13	20.36	15.46	2.67	3.09	4.08
Kharus Patti	195.67	1.90	66.58	17.56	12.83	2.92	3.79	5.18
Kichnar	226.00	2.26	63.18	21.36	14.20	1.20	2.95	4.44
Kohitoor	299.00	1.73	62.25	16.37	17.58	3.30	3.80	3.53
Madhavrao Pasand	134.00	1.10	64.36	17.92	15.70	1.98	3.59	4.09
Malda	572.34	1.83	74.11	13.9	11.76	2.04	6.18	6.29
Mallika	387.34	2.06	72.00	10.97	15.11	1.87	6.56	4.76
Mithua	164.00	1.83	58.49	21.71	18.06	1.69	2.69	3.23
Nisar Pasand	268.33	1.90	66.20	17.96	12.60	3.04	3.68	5.25
Santra	164.67	1.76	60.76	17.62	19.23	2.29	3.44	3.15
Sharda Bhog	165.70	1.50	61.60	20.30	16.23	2.28	3.03	3.79
Sherehayat	212.67	1.93	62.18	19.42	15.09	3.07	3.20	4.11
Sonia Malda	583.34	1.92	75.28	14.00	10.72	2.46	5.37	6.65
Surkha Verma	240.00	1.56	62.73	18.69	16.57	1.95	3.35	3.78
C.D.	41.40	0.56	3.34	2.94	2.53	0.33	-	-
SEm±	14.58	0.20	1.18	1.037	0.89	0.11	-	-
SE(d)	20.63	0.28	1.67	1.46	1.26	0.16	-	-
C.V.	10.02	19.15	3.19	10.03	9.87	8.63	-	-

sucking type variety. Ascorbic acid is an important character particularly with respect to nutritional value of the mango pulp. Considerable amount of vitamin C content is lost during pasteurization of pulp due to its heat labile nature. Highest variation (CV=14.33%) was observed for ascorbic acid content among biochemical parameters in mango varieties. Amount of ascorbic acid varied from 11.90 to 27.33 mg/100 g and observed maximum in Gourjeet (27.33 g/100g) followed by Creeping (24.86 g/100g) and Dashehari (24.80 g/100g) and minimum in Madhavrao Pasand (11.90 g/100g) and Digamber (12.60 g/100g). Pulp content (%) showed significant positive correlation with fruit weight (0.770), pulp/stone (0.868) and pulp/peel ratio (0.911) whereas significant negative correlation was noticed with stone (-0.757) and peel (-0.852) percentage. No significant relation was noticed between pulp, fibre per cent and fruit peel thickness (Table 3).

Four varieties namely; Sonia Malda (75.28%), Malda (74.11%), Mallika (72.00%) and Hybrid 18-8 (72.47%) were possessed more than 70% pulp content while 7 varieties (Amin Tehsilwala, Benzeer, Bombay Bottle, Creeping, Kharauspati, Amrapali, Dashehari and Nisar Pasand) having pulp % between 65-70%. These varieties may be considered suitable for pulp processing and value addition.

Table 2. Biochemical attributes of some commercial and heirloom mango varieties

Variety	TSS (ºBrix)	Titrable acidity (%)	Ascorbic acid (mg/100g)	TSS/acid ratio
Amin Tehsilwala	14.500	0.617	13.267	23.567
Amrapali	20.833	0.316	20.833	65.91
Benzeer	14.733	0.720	18.667	20.483
Benzeer Sandila	16.567	0.643	23.833	25.797
Bombay	20.800	0.487	17.967	42.873
Bombay Bottle	18.533	0.523	23.433	35.687
Creeping	19.167	0.457	24.867	42.277
Cylone	15.700	0.757	14.633	20.820
Dashehari	20.133	0.313	24.800	64.31
Digambar	14.700	0.563	12.600	26.343
Eldon	16.567	0.823	21.000	20.163
Gourjeet	18.267	0.497	27.333	36.767
Gulab Khas	14.600	0.713	22.433	20.507
Himsagar	18.400	0.653	13.667	28.233
Hybrid 18-8	16.600	0.523	22.267	31.763
Inayat Pasand	16.133	0.797	13.433	20.257
KalaPahar	13.967	1.030	16.667	13.703
Kharus Patti	18.000	0.540	23.433	33.457
Kichnar	14.933	0.683	15.167	21.940
Kohitoor	14.733	0.760	18.600	19.497
Madhavrao Pasand	15.233	1.317	11.900	11.753
Malda	15.06	0.540	20.733	37.963
Mallika	20.50	0.450	15.833	45.55
Mithua	18.367	0.480	18.933	38.25
Nisar Pasand	20.500	0.453	17.300	45.403
Santra	15.900	0.807	16.667	19.767
Sharda Bhog	15.000	1.070	22.867	14.173
Sherehayat	12.900	1.290	14.433	10.167
Sonia Malda	14.567	0.887	29.283	16.473
Surkha Verma	17.933	0.737	20.800	24.387
C.D.	1.326	0.123	4.522	4.448
SEm±	0.467	0.043	1.593	1.567
SE(d)	0.661	0.061	2.253	2.216
C.V.	4.819	10.684	14.333	10.009

Table 3. Correlation of different parameters with pulp percentage in mango genotypes

	Pulp (%)	Fruit weight	Peel thickness	Stone (%)	Peel (%)	Fiber (%)	Pulp/ stone	Pulp /peel
Pulp (%)	1.000							
Fruit weight	0.770*	1.000						
Peel thickness	0.117	0.275	1.000					
Stone (%)	-0.757*	-0.643	-0.085	1.000				
Peel (%)	-0.852*	-0.617	-0.185	0.469	1.000			
Fibre (%)	-0.053	0.025	0.351	-0.032	-0.017	1.000		
Pulp/stone	0.868*	0.778	0.112	-0.928	-0.592	-0.0191	1.000	
Pulp/peel	0.911*	0.708	0.178	-0.560	-0.973*	0.002	0.698*	1.000

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