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Variability in *bael* (*Aegle marmelos* Corr.) genotypes from eastern Uttar Pradesh

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ABSTRACT

Surveys were conducted in the districts Gonda, Basti, Gorakhpur, Deoria, Azamgargh, Varanasi, Jaunpur, Sultanpur and Barabanki of Uttar Pradesh during the year 2008-2009. A total of 48 genotypes having desirable traits were collected and physico-chemical analysis of fruits was done. Genotypes showed considerable variation for fruit morphological and physico-chemical traits. The number of fruits per tree varied from (110-315), fruit yield per tree (94.50-356.50 kg), fruit weight (0.55-3.10 kg) among the different genotypes collected. The fruit characteristics, *viz.*, fruit length ranged from (7.70-17.5 cm), fruit circumference (29.0-61.0 cm), number of seeds per fruit (33-200), number of seed sacs per fruit (9-20), shell weight per fruit (0.10-0.73 kg), shell thickness (2.0-5.80 mm), seed weight per fruit (2.8-15.8 g), weight of crude fibre (0.79-2.03 g/100 g pulp), pulp percentage (50.77-73.03) and shell percentage (17.15-32.31) among the different genotypes. With regards to biochemical parameters, TSS ranged from (26.0-44.4°B), acidity (0.30-0.56%), total sugars (13.58-25.53%), reducing sugar (5.59-11.30%), non reducing sugar (4.30-17.07%), vitamin-C content (5.09-18.92 mg/100 g pulp), tannin content (2.01-4.53%) and total carotenoids (1.38-2.72 mg/100 g pulp) among the different genotypes analyzed. On the basis of overall assessment, seven genotypes, *viz.*, T_2, T_{14}, T_{15}, T_{20}, T_{31}, T_{44} and T_{47} were found most promising.

Key words: *Bael*, variability, eastern Uttar Pradesh.

INTRODUCTION

Bael (*Aegle marmelos* Corr.) also known as *shri phal*, is one of the important under utilized fruits of Indo-Malaysian region. It is known in India from prehistoric times and has been mentioned in the ancient system of medicine. The importance of *bael* fruits lies in its curative, pesticidal and nutritive properties. Ripe fruits are laxative and unripe fruits are prescribed for treatment of diarrhea and dysentery and have a great demand in Ayurvedic system of medicine. Every part of the plant such as fruit, seed, bark, leaf and root are important ingredients of several traditional formulations. Apart from medicinal value, it acts as a sink for chemical pollutants as it absorbs poisonous gases from atmosphere and makes them neutral. The tree is also considered under the category of 'Fragrant' species, whose flower and volatile vapours neutralize bad smell of putrefied organic matter or decaying refuge and thus save human life from bacterial attack by making them inert and deodorizing the bad odour of the air (Agarwal, 1). In India, it is found in wild form in sub-Himalayan tracts and dry deciduous forests of central and southern regions from prehistoric times and therefore a large number of ecotypes are available in different regions (Pandey *et al*., 8). A wide range of diversity of *bael* trees has been noticed in dry sub-tropical belts of north India. Plains of Uttar Pradesh have wide distribution of *bael* land races particularly in waste and degraded lands. Recently, few cultivars have been identified and found useful for commercial cultivation, *i.e.*, NB-5 and NB-9 from NDUA&T, Faizabad (Pareek and Nath, 9); Pant Aparna, Pant Shivani, Pant Sujata and Pant Urvashi from GBPUA&T, Pantnagar (Singh *et al*., 14) and CISH-B-1 and CISH-B-2 from CISH, Lucknow (Pathak *et al*., 10).

Some superior genotypes known to local people are on the verge of extinction and there is an urgent need to conserve them for use in posterity (Pandey *et al*., 7). The eastern Uttar Pradesh has high level of variability in *bael* land races. Therefore, a survey was conducted in high variability areas of eastern Uttar Pradesh with a view to identify superior genotypes for various useful traits.

MATERIALS AND METHODS

Survey of *bael* trees was conducted in the districts of Gonda, Basti, Gorakhpur, Deoria, Azamgarh, Varansi, Jaunpur, Sultanpur and Barabanki of Uttar Pradesh in the years 2008 and 2009. During the survey, cultivated as well as forest areas were covered as per method suggested by Gupta and Rai (4). Efforts were taken to identify only regular, prolific bearer, dwarf type with thin shell, having less seed, fibre and

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mucilage contents, pleasant aroma and disease and pest-free healthy trees bearing fruits of uniform shape and size. A total of 48 genotypes having good fruit and tree characters were identified (Table 1). The method of random sampling from a population and biased sampling after gathering information about a particular genotype was followed. Four fruits were randomly collected from all the directions from each genotype to record the morphological and qualitative characters. The extent of variation in morphological and qualitative traits of fruits from different locations was recorded. The physical attributes, *viz*., fruit weight, length, circumference, number of seeds, seed weight, shell weight, shell thickness and pulp weight were calculated following standard procedures. Fruit yield per tree was calculated by counting the number of fruits per tree and multiplying by the average fruit weight. Total soluble solids were estimated in term of degrees Brix with the help of hand refractometer. Titrable acidity was estimated by titrating known amount of pulp against 0.1 N NaOH using phenolpthalein as indicator (Ranganna, 12). Reducing sugar and total sugars were determined by volumetric methods as suggested by Lane and Eynon (5). Ascorbic acid content of fruit was estimated using standardized 2,6-dichlorophenol indophenol dye and expressed as mg per 100 g pulp. The total carotenoids of the pulp were calculated as per method suggested by Ranganna (12). The data were statistically analyzed as per method given by Gomez and Gomez (3) using completely randomized block design.

RESULTS AND DISCUSSION

The data on morphological attributes of *Bael* genotypes depicted in Table 2 showed considerable variability for all the characters studied. The fruit number per tree varied from 110 (T_{16}) to 315 (T_{21}), fruit yield 93.0 kg/tree (T_5)- 356.40 kg/tree (T_{35}) and fruit weight 0.55 kg (T_1) -3.10 kg (T_{16}) among the different genotypes studied. Higher fruit number, fruit weight and fruit yield are the desirable characters and preferred by the people. The fruit length was recorded maximum (17.5 cm) in T_{16} and minimum (8.3 cm) in T_{33} genotype. The fruit circumference was recorded maximum (61.0 cm) in T_{16} genotype, while minimum circumference (29.0 cm) was recorded in T_5 genotype. The shell thickness was found maximum (5.8 mm) in T_{41} genotypes and minimum (2.0 mm) in T_2 genotype. Lower shell thickness (<3.00 mm) was observed in the genotypes T_2, T_7, T_{12}, T_{42}, T_{43}, T_{44} and T_{47}. The thinner shell is considered to be desirable quality character of *bael*. Similar variations in fruit weight, fruit length, fruit circumference and shell thickness were recorded in *bael* genotypes by other workers also (Pandey *et al.*, 8; Nath *et al*., 6; Pandey *et al*., 7).

Pulp weight, pulp percentage, shell weight, shell percentage, seed weight, seed number, number of seed sacs and weight of crude fibre also varied significantly among the genotypes. Maximum pulp weight (2.03 kg per fruit) was recorded in T_{16} while minimum (0.32 kg/fruit) in T_8 genotype. The genotypes T_{43}, T_{18}, T_2 had higher pulp content. The number of seeds per fruit in different genotypes varied from 33 (T_{14}) – 200 (T_{17}). Higher number of seeds per fruit (>100) were recorded in collections T_1, T_9, T_{17}, T_{23}, T_{24}, T_{26}, T_{27}, T_{29}, T_{32}, T_{34}, T_{36} and T_{46} among the different genotypes evaluated. Pareek and Nath (9) reported 46-120 seeds per fruit in different *bael* types, whereas, Rai *et al.* (11) noticed 46-108 seeds per fruit in different *bael* collections identified from eastern Uttar Pradesh. Seed weight in different genotypes also varied greatly from 2.7 (T_4) - 18.0 g/fruit (T_{46}), whereas, the number of seed sacs in different genotypes varied from 9 to 20 (Table 2). The shell weight ranged from 0.10 kg/ fruit (T_1) to 0.73 kg/ fruit (T_{16}) among various *bael* collections evaluated. Crude fibre weight was recorded lowest 0.32 g/100 g pulp in (T_{18}) and was found higher (1.55 g/100 g pulp) in T_{23} among the different collections. The lower seed number, seed weight, number of seed sacs and crude fibre content are preferred characters for collection of superior genotypes. The above observations indicate that for selection of superior *bael* genotype, pulp weight, seed weight and shell weight should be given more importance than fruit weight (Pandey *et al*., 7; Ram and Singh, 13).

The pulp content in form of pulp percentage varied from 50.77-73.03 among the different genotypes analyzed and the genotypes T_{14}, T_{15}, T_{43} and T_{47} were having higher pulp content (>70%). Similarly, the shell percentage ranges from 17.15-32.31 among the different genotypes. Lower shell percentage (<20.00) were recorded in the genotypes, *i.e.*, T_{12} and T_{17}. Higher pulp percentage and lower shell percentage are preferred characters for selection of good quality *bael* genotypes. In all the genotypes, no relation could be established with respect to pulp content, fruit weight, fruit length and fruit circumference which may be attributed to variable seed number, seed size and fibre contents. Through the maximum fruit weight (3.10 kg) was recorded in accession T_{16} with pulp percentage (65.51), the maximum pulp content good (73.03%) was recorded in T_{43} which had fruit weight of 2.15 kg. This may be because of the less seed content and shell weight.

The data depicted in Table 3 showed wide variations in biochemical composition of fruits of the genotypes analyzed. The pulp colour varied from yellow, light yellow, dark yellow, orange yellow and

Table 1. List of *bael* collections from eastern Uttar Pradesh used for variability studies.

Collection No.	Place of collection		Age (year)	Plant height (m)	Crude wt. of fibre (g/100 g pulp)	Pulp (%)	Shell (%)	Yield (kg/tree)	No. of fruits per tree
	Village	District							
T_1	Lodheshwar Gobhara	Barabanki	25	16	1.04	61.82	18.19	118.25	215
T_2	Prahladganj	Gonda	12	08	0.74	72.13	20.00	265.65	161
T_3	Vikas Adhekari	Gonda	10	06	1.35	61.67	25.23	118.80	198
T_4	Chotipurwa	Gonda	60	15	0.66	65.11	30.11	127.2	212
T_5	Kandukpurwa	Gonda	35	16	1.12	58.59	31.43	93.00	310
T_6	Gonda city	Gonda	15	12	0.55	61.36	21.44	161.25	215
T_7	Darjikuwa	Gonda	42	14	0.72	67.61	20.38	187.25	175
T_8	Rampur Kherata	Gonda	16	08	1.10	58.19	21.82	132.0	240
T_9	Kshevpur	Basti	10	09	0.94	66.27	20.01	132.0	165
T_{10}	Baghanara Ridhoura	Basti	13	12	0.70	62.87	24.77	124.95	119
T_{11}	Sangrampur	Basti	25	10	1.02	63.03	26.03	112.32	156
T_{12}	Katya Gotawa	Basti	15	13	1.00	64.49	26.40	123.84	172
T_{13}	Haryia Tanua	Basti	17	08	0.68	63.65	18.19	177.10	161
T_{14}	Haryia Tanua	Basti	13	07	0.66	70.44	20.00	143.75	125
T_{15}	Khapeipara	Basti	15	08	1.02	70.92	21.41	130.56	128
T_{16}	Chauri Chaura	Gorakhpur	23	14	0.53	65.51	23.55	341.00	110
T_{17}	Kusmaurakhurd	Gorakhpur	30	13	0.55	62.87	17.15	157.50	225
T_{18}	Kusmaurakhurd	Gorakhpur	26	15	0.91	64.40	27.83	241.90	118
T_{19}	Pathan tola	Gorakhpur	38	17	0.38	63.35	20.00	193.50	215
T_{20}	Bankatiya	Gorakhpur	46	15	0.09	63.11	22.00	225.00	225
T_{21}	Bankatiya	Gorakhpur	28	15	0.79	61.83	18.19	173.25	315
T_{22}	Rampur	Gorakhpur	36	16	1.01	67.87	24.29	221.20	158
T_{23}	Rajdhani	Gorakhpur	30	14	1.55	66.96	21.74	258.75	225
T_{24}	Deoria Barhaj	Deoria	47	16	1.04	56.67	20.11	189.0	315
T_{25}	Salampur	Deoria	25	11	0.98	58.08	29.04	194.12	211
T_{26}	Shivkarel	Deoria	23	15	0.66	58.63	31.78	326.25	225
T_{27}	Lar road, Deoria	Deoria	32	18	1.02	62.41	23.21	287.50	230

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Collection No.	Place of collection		Age (year)	Plant height (m)	Crude wt. of fibre (g/100 g pulp)	Pulp (%)	Shell (%)	Yield (kg/tree)	No. of fruits per tree
	Village	District							
T_{28}	Turtibar	Deoria	18	09	0.92	66.21	25.24	323.40	154
T_{29}	Turtibar	Deoria	26	15	1.02	56.17	27.71	280.80	216
T_{30}	Deoria Azamgargh marg	Deoria	13	07	0.44	54.45	25.56	138.60	154
T_{31}	Azamgargh	Azamgarh	20	09	0.64	58.92	23.30	174.24	242
T_{32}	Near Mahgit, Azangargh	Azamgarh	22	15	0.75	59.11	25.46	231.0	210
T_{33}	Mohammadpur	Azamgarh	36	18	0.97	50.77	32.31	94.50	315
T_{34}	Mohammadpur	Azamgarh	26	14	0.71	67.52	20.00	193.60	242
T_{35}	Sikandaarpur	Azamgargh	22	10	0.53	61.83	29.10	356.40	216
T_{36}	Sikandaarpur	Azamgargh	43	16	1.01	63.04	28.77	230.40	220
T_{37}	Sikandaarpur	Azamgargh	26	13	0.44	61.44	25.72	169.40	242
T_{38}	Vishunpurwa	Varanasi	33	15	0.51	65.37	24.76	211.0	211
T_{39}	Vishunpurwa Madhi	Varanasi	40	17	2.07	62.39	23.77	235.0	235
T_{40}	Kachwaran	Varanasi	38	14	0.68	53.71	29.48	201.40	212
T_{41}	Taryaien	Varanasi	16	09	0.98	61.06	23.16	203.30	214
T_{42}	Khugi	Varannasi	27	15	0.61	61.27	22.62	168.0	210
T_{43}	Jalalpur	Varanasi	36	14	1.03	73.03	22.33	312.50	125
T_{44}	Bugra	Jaunpur	29	13	0.87	69.92	21.96	241.56	198
T_{45}	Bugra Badshahpur	Jaunpur	47	14	0.37	58.93	23.25	288.60	156
T_{46}	Balaharir	Jaunpu	35	16	1.02	56.12	27.11	216.0	216
T_{47}	Lamuha	Sultanpur	40	14	0.52	71.74	21.38	305.95	211
T_{48}	Dakhwa	Sultanpur	45	13	0.08	64.63	24.62	146.25	225
CD at 5%					0.32	0.31	0.12	12.10	4.93

Table 2. Morpho-physico characteristics of *bael* germplasm collected from eastern Uttar Pradesh.

Collection No.	Fruit wt. (kg)	Fruit length (cm)	Fruit circumference (cm)	No. of seeds per fruit	No. of seed sacs per fruit	Seed wt. per fruit (g)	Shell wt. per fruit (kg)	Shell thickness (mm)	Pulp wt. per fruit (kg)
T_1	0.55	10.7	38.5	134	15	14.9	0.10	2.8	0.34
T_2	1.65	16.0	50.5	80	16	7.2	0.33	2.0	1.19
T_3	0.60	9.7	38.0	49	11	6.2	0.15	5.9	0.37
T_4	0.60	12.0	35.5	38	11	2.7	0.18	3.9	0.39
T_5	0.30	10.0	29.0	72	10	4.9	0.22	4.4	0.41
T_6	0.75	13.0	37.0	80	13	10.9	0.16	4.1	0.46
T_7	1.07	12.7	42.5	200	12	11.4	0.22	2.2	0.73
T_8	0.55	9.2	33.5	52	12	4.8	0.12	3.2	0.32
T_9	0.80	11.7	40.0	131	14	14.5	0.16	4.1	0.53
T_{10}	1.05	12.5	49.5	92	15	8.5	0.26	3.2	0.66
T_{11}	0.72	11.7	41.5	86	12	7.2	0.19	4.0	0.46
T_{12}	0.75	13.5	40.0	75	14	7.2	0.20	3.3	0.49
T_{13}	1.10	12.5	49.0	85	15	9.3	0.20	2.0	0.70
T_{14}	1.15	13.7	47.5	33	09	3.4	0.23	3.1	0.81
T_{15}	1.02	11.0	44.5	82	15	4.6	0.22	3.2	0.73
T_{16}	3.10	17.5	61.0	50	15	3.2	0.73	3.3	2.03
T_{17}	0.70	12.5	40.0	120	15	6.9	0.12	4.0	0.44
T_{18}	2.05	16.0	51.0	80	15	3.9	0.55	3.0	1.32
T_{19}	0.90	13.2	43.5	59	08	4.7	0.18	3.0	0.57
T_{20}	1.00	11.2	43.5	69	13	3.0	0.22	4.8	0.63
T_{21}	0.55	10.2	37.0	59	10	2.8	0.10	3.2	0.34
T_{22}	1.40	13.5	50.0	99	13	7.5	0.34	4.9	0.95
T_{23}	1.15	12.4	44.0	130	14	15.8	0.25	3.0	0.77
T_{24}	0.60	12.0	34.0	123	13	11.8	0.12	6.2	0.34
T_{25}	0.92	12.1	42.0	94	14	10.0	0.27	4.0	0.54
T_{26}	1.45	16.0	44.1	104	13	7.5	0.46	4.0	0.85
T_{27}	1.25	13.0	44.5	103	14	15.3	0.29	2.9	0.78
T_{28}	2.10	14.1	54.0	62	14	8.4	0.53	3.3	1.39
T_{29}	1.30	15.0	45.0	115	16	11.0	0.36	4.8	0.73
T_{30}	0.90	12.2	40.0	67	12	3.3	0.23	3.0	0.49
T_{31}	0.72	10.2	37.0	84	15	8.7	0.17	3.9	0.43
T_{32}	1.10	12.0	45.5	112	14	8.1	0.28	3.1	0.65
T_{33}	0.30	8.5	31.0	77	09	2.8	0.21	4.0	0.33
T_{34}	0.80	11.2	38.5	114	15	12.1	0.16	3.1	0.54
T_{35}	1.65	12.2	47.5	97	16	4.3	0.48	5.8	1.02
T_{36}	0.72	10.2	38.5	150	13	11.5	0.21	3.2	0.46
T_{37}	0.70	11.2	36.5	143	14	8.4	0.18	3.8	0.43

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Collection No.	Fruit wt. (kg)	Fruit length (cm)	Fruit circumference (cm)	No. of seeds per fruit	No. of seed sacs per fruit	Seed wt. per fruit (g)	Shell wt. per fruit (kg)	Shell thickness (mm)	Pulp wt. per fruit (kg)
T_{38}	1.00	13.2	43.0	50	12	3.6	0.25	3.9	0.66
T_{39}	1.00	10.7	43.0	110	13	12.6	0.24	3.9	0.63
T_{40}	0.95	11.0	43.5	41	16	2.9	0.28	3.3	0.51
T_{41}	0.95	12.7	45.0	79	13	5.7	0.22	5.6	0.58
T_{42}	0.80	14.0	42.5	103	14	6.9	0.18	2.1	0.49
T_{43}	2.15	14.2	60.0	91	16	8.8	0.48	2.0	1.57
T_{44}	1.22	14.1	48.0	83	16	9.1	0.27	2.2	0.86
T_{45}	1.85	11.5	57.0	62	20	4.1	0.43	3.5	1.09
T_{46}	1.00	14.7	42.0	138	16	18.0	0.27	4.0	0.56
T_{47}	1.45	13.7	50.0	33	15	3.8	0.31	2.4	1.04
T_{48}	0.65	9.7	39.5	98	12	7.0	0.16	3.0	0.42
CD at 5%	0.35	1.07	4.81	40.25		1.21		1.71	0.12

orange among the different collections. The TSS content ranged from 26°B (T_1) to 49.2°B (T_9). Six genotypes, *viz*., T_3, T_{21}, T_{24}, T_{34}, T_{39}, T_{44} were having more than 45.0°B TSS, whereas, twelve genotypes had more than 40.0°B TSS contents and rest of the genotypes were in the range 26-40°B. The tritable acidity was found minimum (0.30%) in T_{16} and maximum (0.565) in T_{46} genotype. The total sugars content ranged from 13.58% in T_{27} to 25.53% in T_{18} genotypes. The reducing sugar was found maximum (11.30%) in T_{34} followed by 11.12% in T_{20} and minimum 5.59% in T_{36} genotype. The non reducing sugars ranged from 4.38% (T_{27})-18.07% (T_{18}) among the collections analyzed. The vitamin 'C' content was the highest (18.07 mg/100 g pulp) in T_{47} and lowest (5.09 mg/100 g pulp) in T_{11} genotype. The other genotypes ranged between these two limits. The tannin contents varied from 2.01 to 4.53% among the different genotypes analyzed. The total carotenoids content considered to be the most desirable trait in *bael*, ranged from 1.38 mg/100 g pulp in T_{29} to 2.72 mg/100 g pulp in T_{16} genotype. Sixteen genotypes were having higher carotenoids content (>2.0 mg/100 g pulp), however, four genotypes, *viz*., T_{17} (2.52 mg/100 g pulp), T_{39} (2.49 mg/100 g pulp) and T_{41} (2.47 mg/100 g pulp) have much higher contents of total carotenoids. The sugar: acid ratios were higher (80.30) in T_{39} genotype while lowest ratio (28.32) was observed in genotype T_{28}. Similarly, TSS: acid ratio was found maximum (149.0) in T_9 genotype and lowest ratio (65.57) was recorded in T_{36} genotype. The variation in these parameters of *bael* genotypes were also recorded by Charoensiddhi and Anprung (2), Pandey *et al.* (7), and Pandey *et al.* (8).

Based on morphological and physico-chemical parameters of fruits, it is concluded that seven genotypes, two from Basti (T_{14} and T_{15}) and one each from Gonda (T_2), Gorakhpur(T_{20}), Azamgarh (T_{31}), Jaunpur (T_{14}) and Sultanpur (T_{14}) districts of eastern U.P. were found most promising. The grafted plants of these genotypes have been established in the germplasm block for further detailed evaluation.

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Table 3. Bio-chemical characteristics of *bael* germplasm collected from eastern Uttar Pradesh.

Collection No.	Pulp colour	TSS (°Brix)	Acidity (%)	Vitamin 'C' (mg/100 g pulp)	Total carotenoids (mg/100 g pulp)	Total sugars (%)	Reducing sugars (%)	Non-reducing sugars (%)	Sugar: acid	TSS: acid	Tannins (%)
T_1	Yellow	26.0	0.48	9.32	1.75	18.56	8.76	9.80	38.66	54.16	3.21
T_2	Yellow	35.3	0.43	7.99	1.65	15.29	8.54	6.75	35.55	82.09	4.41
T_3	Yellow	44.4	0.51	8.13	1.55	20.84	7.90	12.94	40.86	87.05	3.47
T_4	Yellow	39.0	0.35	14.92	1.89	18.84	6.82	12.02	53.82	111.42	2.51
T_5	Yellow	39.2	0.36	7.59	1.47	15.08	6.45	8.63	41.88	108.88	3.91
T_6	Yellow	36.1	0.49	5.99	1.64	22.92	8.97	13.95	46.77	73.67	4.15
T_7	Yellow	41.3	0.38	8.66	2.00	22.13	8.42	13.71	58.23	108.68	3.10
T_8	Light yellow	35.2	0.44	8.79	1.72	14.35	7.09	7.26	32.61	80.00	3.08
T_9	Yellow	49.2	0.33	12.66	1.99	23.43	10.92	12.51	71.00	149.09	2.59
T_{10}	Yellow	31.2	0.51	10.26	1.88	24.59	8.22	16.37	48.21	61.17	2.01
T_{11}	Yellow	39.0	0.49	5.09	2.00	19.46	6.81	12.65	39.71	79.59	3.15
T_{12}	Yellow	41.2	0.49	15.46	2..11	24.82	9.72	15.10	50.65	84.08	2.87
T_{13}	Yellow	35.3	0.36	12.0	1.76	18.72	8.49	10.23	52.00	98.05	4.31
T_{14}	Light yellow	35.0	0.33	7.86	1.88	19.95	9.79	10.16	60.45	106.06	4.12
T_{15}	Yellow	41.3	0.36	15.99	2.33	22.00	6.38	15.62	61.11	114.72	3.93
T_{16}	Yellow	34.2	0.30	13.33	2.72	20.38	8.53	11.85	67.93	114.00	3.14
T_{17}	Light yellow	36.0	0.49	13.46	2.52	15.16	7.38	7.78	30.93	73.46	3.15
T_{18}	Dark yellow	41.0	0.43	17.59	1.78	25.53	7.46	18.07	59.37	95.34	4.53
T_{19}	Dark yellow	31.2	0.43	7.73	2.26	21.02	10.72	10.30	48.88	72.55	4.27
T_{20}	Dark yellow	37.4	0.48	13.06	1.76	23.53	11.12	12.41	49.02	77.91	3.86
T_{21}	Orange	44.2	0.43	11.99	1.53	16.21	6.28	9.93	37.69	102.79	4.10
T_{22}	Yellow	36.1	0.43	11.59	1.64	17.04	7.84	9.02	39.62	83.95	3.78
T_{23}	Yellow	36.0	0.47	11.06	2.39	17.43	9.05	8.38	37.08	76.59	3.14
T_{24}	Light yellow	44.2	0.49	7.73	1.57	22.51	8.42	14.09	45.93	90.20	3.21
T_{25}	Yellow	44.1	0.48	9.59	1.74	21.53	8.86	12.67	44.85	91.87	2.47
T_{26}	Yellow	32.2	0.43	17.99	1.63	21.53	7.84	13.69	50.06	74.88	2.35

Contd...

Contd...

Collection No.	Pulp colour	TSS (°Brix)	Acidity (%)	Vitamin 'C' (mg/100 g pulp)	Total carotenoids (mg/100 g pulp)	Total sugars (%)	Reducing sugars (%)	Non-reducing sugars (%)	Sugar: acid	TSS: acid	Tannins (%)
T_{27}	Orange	40.2	0.36	13.99	2.16	13.58	9.20	4.38	37.72	111.66	3.14
T_{28}	Yellow	38.4	0.49	15.99	1.82	13.88	7.67	6.21	28.32	78.36	3.25
T_{29}	Orange	43.1	0.35	8.39	1.38	22.85	5.84	17.01	65.28	123.14	2.93
T_{30}	Yellow	36.2	0.33	11.33	2.20	18.81	7.55	11.26	57.00	109.69	3.86
T_{31}	Light orange	39.0	0.44	15.06	2.39	18.92	9.20	11.37	43.00	88.63	3.92
T_{32}	Yellow	43.4	0.38	10.66	1.90	24.48	9.03	15.45	64.42	114.21	2.41
T_{33}	Yellow	35.2	0.44	13.06	2.28	20.85	9.80	11.05	47.38	80.00	2.51
T_{34}	Yellow	44.0	0.43	10.13	2.02	20.99	11.30	9.69	48.81	102.32	3.10
T_{35}	Yellow	36.2	0.42	10.79	1.88	18.28	10.32	9.96	43.52	86.19	3.24
T_{36}	Orange-yellow	34.1	0.52	17.31	1.76	15.46	5.59	9.87	29.73	65.57	3.25
T_{37}	Yellow	36.0	0.42	6.43	2.63	16.42	6.33	10.09	39.09	85.71	3.11
T_{38}	Orange	32.2	0.39	15.46	1.55	17.09	7.66	9.43	43.82	82.56	3.21
T_{39}	Yellow	44.1	0.30	9.33	2.49	24.99	9.15	15.84	80.30	147.00	3.16
T_{40}	Yellow	35.2	0.44	9.73	1.97	15.27	9.23	6.04	34.70	80.00	2.45
T_{41}	Orange	42.0	0.43	7.99	2.47	15.44	9.92	5.52	35.90	97.67	2.31
T_{42}	Yellow	42.0	0.43	9.86	1.70	17.49	6.47	11.02	40.67	97.67	2.35
T_{43}	Yellow	41.4	0.43	15.32	1.59	17.90	8.83	11.43	41.62	96.27	4.19
T_{44}	Yellow	44.2	0.48	6.66	1.89	23.09	10.97	12.12	48.10	92.08	3.78
T_{45}	Orange	34.1	0.46	7.99	1.49	23.33	7.39	15.94	50.70	74.13	2.14
T_{46}	Orange-yellow	34.3	0.56	14.66	1.71	14.52	7.09	7.43	25.92	61.25	2.13
T_{47}	Yellow	54.0	0.32	18.92	1.78	20.76	9.61	11.15	64.87	168.75	4.10
T_{48}	Light-yellow	36.0	0.52	17.79	1.97	20.16	8.74	11.42	38.76	69.23	2.31
CD at 5%		3.05	0.06	1.41	0.07	1.61	1.11	1.01	7.84	16.14	0.43

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