Evaluation of Guava (*Psidium guajava* L.) Genotypes Based on Fruit Morphology, Physico-chemical Properties and Yield under Eastern Plateau Condition

BR Jana, PS Munsi*, DC Manna and Bikash Das**

ICAR-Research Complex for Eastern Region, Research Center, Plandu, Ranchi-834010, Jharkhand
**Department of CIHAB, Pallisiksa bhabana, Visva-Bharati University, Shantiniketan, West Bengal*
***Rathindra KVK, Pallisiksa Bhabana, Visva-Bharati University, Shantiniketan, West Bengal*

Thirty-two guava germplasm were evaluated on the basis of fruit morpholology, physico-chemical properties and yield at ICAR Research Complex for Eastern Region, Research Center, Ranchi during 2007-08. High yielding cultivars were CHG-1, Allahabad Safeda, Mild Flesh, Sardar and White Flesh. The fruit of CHG-1 cultivar was round shaped with pink flesh and having smooth surface. On the other hand, the fruit of Allahabad Safeda cultivar was round shaped and had creamy pulp and smooth surface. The fruit of Sardar and White Flesh cultivars were oval shaped and had white pulp and rough surface. The characteristics of Mild Flesh cultivar was round fruited with white pulp and smooth surface. With regard to physico-chemical properties of the genotypes, the cultivar Spear Acid accounted for the maximum fruit weight (179.4 g) and ascorbic acid content (265.83 mg/100 gm pulp) whereas the cultivar CHG-5 had higher T.S.S. content of 10.26°B during rainy season. As winter crop, the cultivar Mild Flesh recorded the maximum fruit weight of 199.1 g whereas the cultivars Seed Drop and Kairala Seedling exhibited highest T.S.S. content of 12.86°B but later had the maximum ascorbic acid content of 358.33 mg/100 gm pulp. The only cultivar Barbadose Superior did not produce fruit during winter. During summer season, six cultivars, *viz.* Mild Flesh, Seed Drop, Surkh Gudi, CHG-1, CHG-2 and Eskwala brought forth fruit. The cultivar Eskwala recorded the highest fruit weight of 139.8 g and the cultivar Seed Drop exhibited the maximum TSS content of 14.36°B and ascorbic acid content of 337.5 mg/100gm pulp. Hence, based on fruit morphology, quality and total yield CHG-1, Allahabad Safeda, Mild Flesh, Sardar, White Flesh, Spear Acid and Seed Drop were found promising for cultivation in the plateau region of Jharkhand.

Key Words: Guava, Evaluation, Fruit shape, Flesh colour, TSS, Ascorbic acid, Yield

Introduction

The guava (*Psidium guajava* L.) 'Apple of Tropics' is one of the major fruit crops grown in subtropical, sub-humid climate under eastern plateau and hill region. In the present investigation, thirty-two guava cultivars and seedlings which excelled over most other guava cultivars in term of productivity and physico-chemical characters were evaluated. Description of guava cultivars on the basis of botanical and pomological characters are most useful tools for systematic botanist and pomologist for further research and equally good for the people concerned with guava industry. Maintenance of superior genotypes in respect of fruit and other characters for further crop improvement programmes is essential. The soil and climatic conditions of eastern plateau and hill agro-climatic zone offer suitable conditions for successful cultivation of guava under irrigated and rain-fed conditions as well. The ease in cultivation and precociousness of guava (after two-years attains bearing stage) under these conditions makes it a suitable option for increasing the paddy equivalent yield of agriculture production system. Keeping the above point in view, the present investigation was undertaken to evaluate guava genotypes on aspect of fruit morphology, nutritive quality and total yield under subtropical sub humid climate of Chotanagpur.

Materials and Methods

The experiment was conducted at ICAR Research Complex for Eastern Region, Research Center, Ranchi during 2007-08. This area is situated 620 m above mean sea level (msl) and at 23°25' N latitude and 85°20' East longitude experiencing an average annual rainfall of 110-140 cm. High humidity (78.14%-84.14%) and low evaporation rate (4.04 mm/day) is experienced after June which continues up to onset of winter (Singh, 1999). Soil is acidic and pH range from 5.0-6.5, which is ideal for guava cultivation. The important cultivars for evaluation were Kairala Seedling (T_1), Barkhana (T_2), Florida Flesh (T_3), Chittidar AC (T_4), Mild Flesh (T_5), Seed Drop (T_6), Barbadose Superior (T_7) ,Surkh Gudi (T_8), Chittidar (T_9), Allahabad Collection (T_{10}), Sangam (T_{11}), Sardar (T_{12}), Allahabad Safeda (T_{13}), Mustafapur (T_{14}), Behat Coconut (T_{15}), Pear Shaped (T_{16}), Apple Colour (T_{17}), Harijha (T_{18}), Banarasi (T_{19}), Superior (T_{20}), White Flesh (T_{21}), Guatemala (T_{22}), CHG-1 (T_{23}), CHG-3 (T_{24}),

CHG-5 (T_{25}), CHG-2 (T_{26}), Spear Acid (T_{27}), Nasik (T_{28}), Eskwala (T_{29}), Sindh (T_{30}), Patiala (T_{31}) and Smooth Green (T_{32}). Cultivars were evaluated in rainy, winter and summer season. Each cultivar represented one treatment. The experiment was laid out in randomized block design with four replications. Fruit botanical descriptions were measured by the descriptor given by proceeding of the group workers meeting on subtropical fruits (AICRP on Sub-tropical fruits). Titratable acidity was estimated by titrating the fruit extract with 0.1 N NaOH using phenolphthalein as an indicator and expressed as percent citric acid equivalent. The estimation of vitamin C in fresh fruits was carried out using 2, 4-6 dichlorophenol indophenol dye. Reducing and total sugar was estimated by Lane and Eynon method (Ranganna, 1977).

Results and Discussion

In our study, from yield point of view, five cultivars, *viz*., CHG-1(41.12 kg/tree/year), Allahabad Safeda (37.76 kg/tree/year), Mild Flesh (36.99 kg/tree/year), Sardar (36.03 kg/tree/year) and White Flesh (35.73 kg/tree/year) were high yielder. In a different experiment conducted at Sabour, Bihar, Singh *et al.* (2002) found that Allahabad Safeda exhibited superior yield of 72 kg and 42 kg during rainy and winter season, respectively as compared to the other germplasm. Kundu and Mitra (1994) reported that maximum yield of 5.8 kg and 44.6 kg during winter and rainy season, respectively, in the laterite tract of West Bengal. A close perusal of the Table 1 revealed that the fruit of CHG-1 cultivar was round shaped with pink flesh and having smooth surface and creamy white peel colour. On the other hand, the fruit of Allahabad Safeda cultivar was round shaped and had creamy pulp and creamy white peel colour with smooth surface. The fruit of Sardar and White Flesh cultivars were oval shaped and had white pulp and rough surface with light green peel colour. The only difference of these two cultivars was the former cultivar had broadly round fruit apex but later cultivar possessed flat fruit apex. The cultivar Mild Flesh was round shaped with white pulp and creamy

Table 1. Fruit morphological characters of guava cultivars assessed during 2007-2008

Cultivars	Fruit shape	apex	Base	Cavity	Surface	Peel colour	Peel thickness	Pulp colour
Kairala Seedling	Round	Broadly round	Tapering	Absent	Smooth	Light green	Thick	White
Barkhana	Round	Broadly round	Rounded	Absent	Smooth	Creamy white	Thick	White
Florida Flesh	Round	Broadly round	Rounded	Absent	Rough	Light green	Medium	White
Chittidar AC	Oval	Flat	Tapering	Absent	Rough	Light green	Thin	White
Mild Flesh	Round	Broadly round	Rounded	Absent	Smooth	Creamy white	Thin	White
Seed Drop	Round	Broadly round	Rounded	Shallow	Smooth	Yellowish reddish	Medium	White
Barbadose Superior	Round	Broadly round	Rounded	Absent	Smooth	Light green	Thin	Cream
Surkh Gudi	Oval	Broadly round	Tapering	Shallow	Smooth	Light green	Thin	White
Chittidar	Oval	Flat	Tapering	Shallow	Smooth	Light green	Thin	White
Allahabad Collection	Round	Broadly round	Rounded	Absent	Rough	Yellowish reddish	Thin	Cream
Sangam	Oval	Broadly round	Tapering	Shallow	Smooth	Light green	Thin	Cream
Sardar	Oval	Broadly round	Tapering	Shallow	Rough	Light green	Medium	White
Allahabad Safeda	Round	Broadly round	Rounded	Shallow	Smooth	Creamy white	Thin	Cream
Mustafapur	Round	Broadly round	Rounded	Shallow	Smooth	Creamy white	Thin	White
Behat Coconut	Oval	Flat	Tapering	Shallow	Rough	Creamy Wwhite	Medium	Cream
Pear Shaped	Pyriform	Broadly round	Tapering	Absent	Smooth	Light green	Medium	White
Apple Colour	Round	Broadly round	Rounded	Absent	Rough	Yellowish reddish	Thin	White
Harijha	Oval	Broadly round	Rounded	Absent	Smooth	Light green	Thin	White
Banarasi	Oval	Broadly round	Tapering	Absent	Rough	Yellowish reddish	Thin	Cream
Superior	Round	Rounded obtuse	Tapering	Intermediate	Smooth	Light green	Thin	Cream
White Flesh	Oval	Flat	Tapering	Shallow	Rough	Light green	Thin	White
Guatemala	Oval	Broadly round	Tapering	Absent	Smooth	Light green	Thin	White
CHG-1	Round	Broadly round	Rounded	Absent	Smooth	Creamy white	Thin	Pinkish
CHG-3	Round	Broadly round	Rounded	Shallow	Rough	Light green	Medium	White
CHG-5	Round	Broadly round	Rounded	Absent	Smooth	Yellowish reddish	Medium	Cream
CHG-2	Round	Broadly round	Rounded	Absent	Rough	Yellowish reddish	Thin	Pinkish
Spear Acid	Oval	Flat	Tapering	Absent	Rough	Creamy white	Medium	White
Nasik	Pyriform	Broadly round	Tapering	Absent	Smooth	Creamy white	Thin	White
Eskwala	Round	Broadly round	Rounded	Absent	Smooth	Light green	Thick	White
Sindh	Round	Broadly round	Rounded	Shallow	Smooth	Creamy white	Thin	Cream
Patiala	Round	Broadly round	Rounded	Absent	Smooth	Creamy white	Medium	White
Smooth Green	Oval	Flat	Tapering	Shallow	Smooth	Light green	Medium	White

white peel colour. The cultivars Pear Shaped and Nasik were pyriform in shape with white pulp but peel colour of former cultivar was light green whereas later was creamy white.

In the present investigation, during rainy season, the maximum fruit weight was recorded in cultivar Spear Acid (179.41 g) (Table 2) and during winter season the cultivar Mild Flesh exhibited maximum fruit weight of 199.13 g (Table 3). This finding corroborates the results of Tandon *et al.* (1983) and Singh *et al.* (2002). The fruits of CHG-5 recorded the maximum TSS (10.26ºB) in rainy season whereas in the winter season Kairala Seedling and Seed Drop recorded the maximum TSS of 12.86ºB. These findings are in agreement with results reported by Kundu *et al.* (1995). In our present study, the maximum titratable acidity was observed in case of Chittidar AC (0.36%) during rainy season whereas; Seed Drop recorded maximum acidity of (0.32%) during winter season followed by cultivar Kairala Seedling. In rainy season the maximum ascorbic acid content was found in case of cultivar Spear Acid (265 mg/100 g pulp) followed by Sooth Green (262 mg/100 g pulp). But in winter season, the maximum ascorbic acid was found in cultivars Kairala Seedling (358 mg/100 g pulp). In a different study, Tandon *et al.* (1983) found that Behat Coconut accounted for the maximum ascorbic acid of 295.7 mg/100gm in winter season. Singh *et al.* (1995) also reported that the maximum vitamin C was found in case of cultivar Superior in winter season. The highest total sugar was found in case of genotype CHG-3 (4.2%) during rainy season but the cultivar Florida Flesh accounted for the minimum total sugar of 4.37 per cent during winter season. Singh *et al.* (2002) reported that the maximum total sugar of 9.13% was found in case of

Table 2. Physico-chemical characters and yield of rainy season guava crop during 2008

Cultivars	Fruit size (cm^2)	Fruit weight (gm)	TSS (ºB)	Acidity (%)	Reducing sugar (%)	Total sugar (%)	Ascorbic acid (mg/100 gm pulp)	Yield (kg/tree)
Kairala Seedling	36.30	112.41	8.80	0.24	2.55	2.81	158.33	14.40
Barkhana	39.18	113.00	9.36	0.22	2.05	3.34	243.33	11.90
Florida Flesh	37.17	117.83	8.43	0.18	1.92	2.57	246.66	17.60
Chittidar AC	36.77	113.58	8.63	0.36	2.21	2.55	185.00	22.13
Mild Flesh	29.32	98.00	10.00	0.31	2.70	3.44	171.66	19.93
Seed Drop	31.92	102.25	8.63	0.18	1.74	2.63	204.16	18.70
Barbadose Superior	31.35	97.33	8.80	0.13	2.58	2.88	189.16	13.30
Surkh Gudi	38.22	138.66	9.73	0.15	1.92	3.00	208.33	12.53
Chittidar	47.81	159.75	8.73	0.14	2.13	2.94	227.50	19.90
Allahabad Collection	42.18	122.16	10.06	0.15	2.00	3.26	195.83	12.40
Sangam	31.48	108.16	9.00	0.16	2.20	3.42	187.50	13.50
Sardar	41.61	128.16	9.20	0.14	2.14	3.26	218.33	23.43
Allahabad Safeda	43.29	125.83	9.46	0.13	2.34	3.54	241.67	24.86
Mustafapur	28.71	78.83	9.93	0.18	2.11	3.57	244.16	17.90
Behat Coconut	33.35	102.75	9.46	0.16	2.05	2.90	241.67	18.90
Pear Shaped	29.28	96.50	9.33	0.19	1.90	3.39	242.50	18.56
Apple Colour	32.08	99.50	8.93	0.14	2.63	3.01	200.00	13.16
Harijha	39.01	154.16	10.06	0.16	1.97	3.41	183.33	17.80
Banarasi	32.10	87.25	9.53	0.16	2.28	3.57	173.33	15.70
Superior	34.38	100.33	9.53	0.19	2.16	3.08	181.66	16.40
White Flesh	41.05	128.16	8.80	0.13	2.17	2.73	231.66	24.20
Guatemala	41.38	127.08	9.40	0.14	2.02	3.38	141.66	17.93
CHG-1	34.20	102.41	10.06	0.14	2.12	3.61	210.83	23.93
CHG-3	39.05	128.75	9.20	0.18	2.68	4.20	185.83	19.56
CHG-5	36.69	105.83	10.26	0.15	2.14	3.23	201.66	22.26
CHG-2	32.67	104.58	8.20	0.17	2.32	2.69	194.16	18.46
Spear Acid	47.24	179.41	10.06	0.16	2.02	2.83	265.83	19.50
Nasik	32.48	78.25	9.59	0.18	2.68	3.30	210.83	18.53
Eskwala	34.33	130.16	9.0	0.27	2.46	3.44	192.50	20.16
Sindh	33.81	107.33	9.0	0.12	2.63	3.35	195.00	20.00
Patiala	30.19	92.33	8.06	0.13	1.88	3.14	203.33	20.53
Smooth Green	38.96	133.58	8.73	0.20	2.06	2.76	262.50	21.26
CD at 5 %	1.899	3.648	0.4138	0.062	0.237	0.285	15.237	1.702

Table 3. Physico-chemical characters and yield of winter season guava crop during 2008

Cultivars	Fruit size (cm^2)	Fruit weight (gm)	TSS (°B)	Acidity (%)	Reducing sugar (%)	Total sugar (%)	Ascorbic acid (mg/100 gm pulp)	Yield (kg/tree)
Kairala Seedling	38.43	131.73	12.86	0.30	3.13	3.53	358.33	9.56
Barkhana	31.58	103.66	11.66	0.23	2.73	3.07	250.00	8.26
Florida Flesh	38.33	154.00	11.86	0.20	2.79	4.37	250.00	9.20
Chittidar AC	33.63	145.80	10.06	0.25	3.07	3.37	229.16	11.20
Mild Flesh	46.37	199.13	9.26	0.16	2.74	3.01	216.66	12.13
Seed Drop	48.32	167.93	12.86	0.32	3.20	3.90	276.66	8.80
Barbadose Superior	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Surkh Gudi	39.02	155.93	9.13	0.18	2.81	3.81	280.83	7.30
Chittidar	43.10	174.46	10.0	0.28	2.98	3.85	237.50	10.53
Allahabad Collection	35.73	139.53	9.26	0.28	2.70	3.40	212.50	7.33
Sangam	37.61	120.80	9.33	0.26	3.28	3.78	204.16	5.50
Sardar	48.43	130.66	11.66	0.17	2.47	4.12	279.16	12.6
Allahabad Safeda	43.16	129.60	12.33	0.15	2.95	4.25	300.00	12.9
Mustafapur	38.70	139.40	10.13	0.26	2.73	3.37	183.33	8.90
Behat Coconut	32.92	110.33	9.16	0.29	3.59	4.24	262.50	10.03
Pear Shaped	39.08	142.53	10.83	0.32	2.88	3.33	204.16	8.86
Apple Colour	40.08	173.06	9.83	0.19	2.89	3.59	191.66	6.76
Harijha	36.23	135.93	9.00	0.18	2.66	3.19	262.50	9.00
Banarasi	29.91	109.60	9.46	0.21	2.77	3.80	262.50	7.63
Superior	45.03	164.06	9.83	I0.27	2.51	2.73	333.33	8.10
White Flesh	50.56	167.80	9.93	0.31	2.18	2.45	237.50	11.53
Guatemala	29.65	112.93	9.66	0.17	2.93	3.65	312.50	8.60
CHG-1	42.25	143.66	8.16	0.23	2.74	3.14	225.00	11.86
CHG-3	38.76	135.60	9.53	0.16	2.31	2.77	208.33	8.83
CHG-5	40.66	156.60	9.86	0.26	2.82	3.35	252.50	10.83
CHG-2	34.77	130.33	8.93	0.26	2.31	3.23	214.16	8.73
Spear Acid	37.34	139.33	9.76	0.23	2.79	3.55	207.50	9.56
Nasik	34.89	119.13	9.93	0.18	3.04	3.47	237.50	9.53
Eskwala	27.64	84.20	8.93	0.14	2.62	2.87	225.83	9.91
Sindh	37.97	134.80	9.73	0.20	2.73	3.11	205.83	10.00
Patiala	33.84	111.13	8.86	0.27	3.05	3.53	211.66	10.16
Smooth Green	33.81	119.66	8.06	0.21	2.98	3.41	250.00	9.66
CD at 5%	2.459	1.353	0.406	0.028	0.150	0.338	23.173	1.220

Table 4. Physico-chemical characters and yield of summer season guava crop during 2008

Cultivars	Fruit size (cm^2)	Fruit weight (gm)	TSS (°B)	Acidity (%)	Reducing sugar (%)	Total sugar (%)	Ascorbic acid (mg/100 gm pulp)	Yield (kg/tree)
Mild Flesh	29.57	90.15	13.12	0.295	2.59	5.24	285.62	4.93
Seed Drop	33.29	109.00	14.27	0.310	5.81	6.82	338.12	4.20
Surkh Gudi	33.94	110.72	12.07	0.297	2.40	5.33	289.37	3.73
CHG-1	24.92	67.57	11.67	0.277	2.10	4.81	212.62	5.33
CHG-2	34.59	96.07	11.25	0.265	2.79	4.64	235.87	4.10
Eskwala	35.69	138.70	12.22	0.270	2.95	5.44	315.37	3.76
CD at 5%	1.017	5.441	0.223	0.025	0.369	0.190	14.438	0.381

cultivar Allahabad Safeda during winter season at Sabour (Bihar) condition. The only cultivar Barbadose Superior did not produce fruit during winter. During summer season, six cultivars, *viz.*, Mild Flesh, Seed Drop, Surkh Gudi, CHG-1, CHG-2 and Eskwala brought forth fruit. In summer season, fruit size and weight was smaller than that of rainy and winter season crop. The cultivar Eskwala recorded the highest fruit weight of 139.8 g and the cultivar Seed Drop exhibited the maximum TSS content of 14.36°B and ascorbic acid content of 337.5 mg/100 gm pulp (Table 4). Yield of summer season crop was also low due to cultivation under rainfed condition and higher temperature.

Hence, based on fruit morphology, fruit weight, TSS, Ascorbic acid content CHG-1, Allahabad Safeda, Mild Flesh, Sardar, White Flesh, Spear Acid, Seed Drop and

Kairala Seedling were found suitable for cultivation under rainfed condition in the plateau region of Jharkhand.

References

Kundu S and SK Mitra (1994) Studies on flowering and fruiting of some guava cultivars in the laterite tract of West Bengal. *Haryana J. Hort. Sci.* **23(3):** 213-18.

Kundu S, SN Ghosh and SK Mitra (1995) Physico-chemical characters of twelve guava cultivars in the laterite tract of West Bengal. *Indian Fd. Packer* **49(2):** 11-16.

Ranganna S (1977) Manual of analysis of fruits and vegetables product. Tata McGraw-Hill Publishing Co. Ltd. New Delhi, 29-31.

Singh G, GC Sinha, D Pandey and S Rajan (1995) Studies on the physico-chemical composition of twenty-four guava varieties. *Indian Fd. Packer* **49(3):** 15-20.

Singh HP (1999) Horticulture Development in Tribal Areas. *Proc. of National Seminar on Sustainable Horticultural Production in Tribal Regions*, July 25-26, 5-18.

Singh S, J Singh and MN Hoda (2002) Evaluation of guava germplasm under Sabour (Bihar) conditions. *Indian J. Agri. Sci.* **72(7):** 393-395.

Tandon DK, SK Kalra, H Singh and KL Chadha (1983) Phisico-chemical characteristics of some guava varieties. *Prog. Hort*. **15(1-2):** 42-44.