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Comparative study on physico-chemical properties of F_1 hybrids and its parent of guava *(Psidium guajava* L.*)* in Terai Agro-Climatic Zone of West Bengal

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ABSTRACT

An experiment was conducted at Instructional Farm of Department of Pomology and Post-Harvest Technology, Uttar Banga Krishi Viswavidyalaya, during 2019-2020 and 2020-2021, for a comparative study of the guava. A restricted crossing programme was conducted using Red Fleshed genotype as pollen doner plant and four white-fleshed genotypes as fruit giving plant. All the parents as well as their F_1 hybrids were evaluated. The treatment combination was T_1: Allahabad Safeda, T_2: Baruipur, T_3: L-49, T_4: Doodh Khaja, T_5: Red Fleshed, T_6: Allahabad Safeda × Red Fleshed, T_7: Baruipur× Red Fleshed, T_8: L-49 × Red Fleshed, T_9: Doodh Khaja × Red Fleshed. Results revealed that T_9(Doodh Khaja × Red Fleshed) has maximum value for the characteristics like fruit weight (231.36 g), fruit length (6.84 cm), fruit width (5.64 cm), 100 seeds weight (1.67 g) and fruit yield (17.38 kg tree^{-1}). Whereas T_7 (Baruipur × Red Fleshed) has highest TSS (11.03°B), acidity (0.36%), total sugar (7.11%), reducing sugar (4.90%), meanwhile maximum ascorbic acid (143.00 mg 100g^{-1} pulp) was found in T_8 (L49 × Red Fleshed). All the F_1 hybrids showed better result as compare to their parent plant.

***Keywords*:** Guava, parents, F_1 hybrids, comparative, fruit characteristics and physico-chemical properties.

Guava (*Psidium guajava* L) belonging Myrtaceae family, having chromosome number 2n= 22 is also popularly known as an apple of tropics, which contains large number of fruits yielding species (Ray, 2002). In north Indian condition guava tree produces flowers and fruits twice a year whereas in South Indian condition it produces flowers and fruits three times in a year. Guava production in West Bengal is 203.6 Tonnes and shares about 6.00% (Anonymous, 2022). Guava is strong, profuse bearer and profitable crop. The fruit of guava is widely employed in processing industry and is used to make a various processed products like jelly, candy, pudding and leather. Due to its nutritional properties, flavour, easy availability in market at reasonable cost it is gaining popularity day by day. It can withstand temperature as low as 5^{0}C during night time (Wei, 2008). Guava can tolerate pH ranges from 4.5 to 9.4 and can be grown in wide range of soil condition as well as on heavy clay, light sand and limestone.

It contains highest Vitamin C (299mg/100g pulp). It is high in Vitamin A, calcium, phosphorus, potassium, sulphur, salt, chlorine, magnesium, riboflavin (B_2), thiamine (B_1), and niacin (FAO, 2009). It also has a lot of iron, although 80 percent of it stays in the seed (Millar and Bazor, 1945). Red colour fruits have equal demand on fresh as well as in processing industries due to its highest nutritional properties. The growth cycle is affected by both plant genotype and climatic conditions. Variations in spontaneous fruit set were observed ranging from 22 to 75 percent in cultivar Lucknow-49. In terms of salt tolerance some of the guava cultivars are undeniably versatile than others. Native plants in each country are frequently more adaptable and resistant to unfavorable environmental conditions. Though, in most of the time, the characteristics of guava plant was not methodically investigated (Sanchez-Blanco *et al*., 1998).

A cautious selection of cultivars from different agro-climatic zones is critical for attaining optimum production and superiority of guava (Dolkar *et al*., 2014). Locally available guava cultivars, on the other hand, show more variation in bearing habit, tree shape and size, fruit shape, size, colour, production as well as quality and ripening season. Despite the fact that physico-chemical characteristics are susceptible to environmental factors. Therefore, selection of good parents and their hybrids for comparative studies in terms of fruit physico-chemical properties is highly necessary to achieve promising guava cultivar. In view of this, an experiment was carried out with the objective

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of comparative study of physico-chemical properties of different guava parents and F_1 hybrids to identify stable guava cultivars suitable to local agro-climatic region with better fruit quality that prove highly remunerative to the growers for improved economic yield.

MATERIALS AND METHODS

This experiment was conducted in Instructional Farm of Department of Pomology and Post-Harvest Technology, Uttar Banga Krishi Viswavidayalaya, Pundibari, Cooch Behar with following treatments T_1: Allahabad Safeda, T_2: Baruipur, T_3: L-49, T_4: Doodh Khaja, T_5: Red Fleshed, T_6: Allahabad Safeda × Red Fleshed, T_7: Baruipur × Red Fleshed, T_8: L-49 × Red Fleshed, T_9: Doodh Khaja× Red Fleshed. As the experimental site is present at $26^0$19‘86“ N latitude and $89^0$23‘53“ E longitude (measured with GPS Garmin-72) and at an altitude of 80 m above the mean sea level therefore the area comes under the Terai Agro-Climatic Zone of West Bengal. Red Fleshed genotype was used as pollen doner plant and four white-fleshed genotypes as fruit giving plant by making restricted crossing among them.

Methodology of crossing

1. For making cross the female flower was emasculated 1 hour before anthesis.

2. Bud emasculation: emasculation was done guava flower with calyx rapture and total elimination of anther sepals and petals to prevent any possibility of self-pollination. Immediately after emasculation, the flowers were bagged with butter paper to prevent random cross-pollination. Small perforations were made on butter paper for aeration.

3. Emasculated flowers were pollinated within 2 hours by fresh pollen from Red Fleshed and re-bagged.

4. Bags were removed after 5-6 days of fruit set.

The entire data of the present investigation were analyzed employing Randomized Block Design with three replications under each treatment by Opstat software.

Physical characters of fruit

Fruit length and width was calculated with the vernier caliper and expressed in centimeter. A total length and width of ten fruits pre replication was taken and after that average value was calculated. Fruit weight and seed weight was calculated with the help of digital balance and expressed in gram . Total ten fruits weight per replication and a total 100 seeds per replication was taken and after that average value was calculated. The number of seeds 100 g^{-1} fruit was measured. Yield per tree was calculated by multiplying number of fruits harvested per tree with its average weight.

Bio-chemical characters of fruit

Estimation of bio-chemical characteristics like Total Soluble Solid, Titratable Acid, TSS: Acid ratio, Reducing Sugar, Total Sugar, Ascorbic Acid was done by the procedure given by Ranganna (1979).

RESULTS AND DISCUSSION

Physical characters of fruit

Fruit weight (gram)

Fruit weight was observed maximum in T_9 (Doodh Khaja × Red Fleshed) 231.36 g followed by T_4 (Doodh Khaja) 190.82 g, T_6 (Allahabad Safeda×Red Fleshed) 189.71 g and minimum was recorded in T_5 (Red Fleshed) 134.07 g. In most of the cases fruit weight was higher in F_1 hybrids as compare to parent (Table 1).

The finding was supported by Mehta *et al*. (2016) where maximum weight of guava fruit was observed (158.08 g). Similarly, Jana *et al*. (2016) recorded maximum weight of fruit in variety Chittidar (265.67 g) followed by Sardar (234.3 g). Singh *et al*. (2016) also observed fruit weight 87.2 g – 152.0 g in Lalit.

Fruit length (centimeter)

Experimental results showed that mature fruit length was maximum in T_9 (Doodh Khaja × Red Fleshed) 6.84 cm, followed by T_8 (L-49 × Red Fleshed) 4.89 cm and minimum was recorded in T_5 (Red Fleshed) 3.90 cm. In comparison with parent plant, F_1 showed larger fruit length of fruit in most of the cases (Table 1). The findings were also supported by Mehta *et al.* (2018).

Fruit width (centimeter)

Experimental results showed that mature fruit width was maximum in T_9 (Doodh Khaja × Red Fleshed) 5.64 cm followed by T_8 (L-49 × Red Fleshed) 4.99 cm and minimum was recorded in T_2 (Baruipur) 4.18 cm. In comparison with parent plant, F_1 showed larger fruit width in most of the cases (Table 1).

Seed weight (gram)

Seed weight was observed maximum in T_9 (Doodh Khaja × Red Fleshed) 1.67 g which was statistically at par with T_7 (Baruipur × Red Fleshed) 1.57 g and minimum was recorded in T_5 (Red Fleshed) 0.86 g (Table 1).

Number of seed per 100-gram fruit

The data revealed in Table 1 showed that number of seed 100 g^{-1} fruit was highest in T_6 (Allahabad Safeda × Red Fleshed) 207.71 which was at par with T_6 (L-49 × Red Fleshed) 202.73, T_1 (Allahabad Safeda) 201.67 and minimum was recorded in T_5 (Red Fleshed) 11.93.

Fruit yield (kilogram)

Fruit yield was recorded maximum in T_9 (Doodh Khaja × Red Fleshed) 17.38 kg $tree^{-1}$ which was statistically at par with T_6 (Allahabad Safeda × Red

Fleshed) 16.12 kg tree^{-1}, T_4 (Doodh Khaja) 15.83 kg tree^{-1} and minimum was recorded in T_7 (Baruipur × Red Fleshed) 13.11 kg tree^{-1} (Table1). In most of the cases, F_1 shows better result than both of their parent which may be due to heterobeltiosis. The similar result was reported by Swaminathan *et al*. (1972) where heterobeltiosis was more than 20% over better parent.

Bio-chemical characters of fruit

Total Soluble Solids (° Brix)

Total Soluble Solid was observed highest in T_7 (Baruipur × Red Fleshed) 11.03°B followed by T_6 (Allahabad Safeda × Red Fleshed) 10.57°B and minimum was recorded in T_5 (Red Fleshed) 8.10°B (Table 2). In comparison with parent total soluble solids were observed higher in F_1 hybrids. The findings were similar with Sharma *et al*. (2010) where TSS ranged between 9.4 and 13.5 °Brix in different cultivars where maximum was observed 13.5 °Brix in 'Hybrid Red Supreme'.

Titratable acidity percentage

Non-significant variation was revealed for the character titratable acidity content among different treatments (Table 2). The highest acidity was recorded in T_7 (Baruipur × Red Fleshed) 0.36% and lowest was recorded in T_4 (Doodh Khaja) 0.29%. The finding was similar with Dolkar *et al.* (2014) where L-49 showed the minimum acidity and minimum acidity was recorded in Pant Prabhat. They reported the acidity was ranged from 0.36 to 0.30 %. Sharma *et al*. (2019) also reported that the acidity was maximum in 'Chinese guava' (0.96%) and minimum acidity in 'Hisar Safeda' (0.37%).

TSS: acid ratio

The data presented in Table 2 showed that the TSS: Acid ratio was recorded highest in T_6 (Allahabad Safeda) × Red Fleshed (35.22) which was followed by T_1 (Allahabad) (31.38) and lowest was recorded in T_5 (Red Fleshed) (23.18). Patel *et al*. (2015) also observed TSS:acid ratio more than 21.0.

Table 1 : Physical characters of fruit

Treatment	Fruit weight (g)	Fruit length (cm)	Fruit width (cm)	100 seed weight (g)	Number of seed 100 g^{-1} fruit	Fruit yield kg tree^{-1}
T_1	146.14	4.40	4.50	0.99	201.67	15.08
T_2	140.78	4.07	4.18	1.12	184.75	13.28
T_3	160.65	4.72	4.47	0.99	168.15	14.99
T_4	190.82	4.54	4.67	1.17	167.54	15.83
T_5	134.07	3.90	4.06	0.86	111.93	15.10
T_6	189.71	4.83	4.71	1.52	207.71	16.12
T_7	180.42	4.42	4.35	1.57	181.67	13.11
T_8	187.72	4.89	4.99	1.27	202.73	15.01
T_9	231.36	6.84	5.64	1.67	100.91	17.38
SEm(±)	**1.14**	**0.14**	**0.14**	**0.01**	**2.43**	**0.52**
LSD (0.05)	**3.45**	**0.43**	**0.41**	**0.04**	**7.35**	**1.59**

*T_1: Allahabad Safeda, T_2: Baruipur, T_3: L-49, T_4: Doodh Khaja, T_5: Red Fleshed, T_6: Allahabad Safed × Red Fleshed, T_7: Baruipur × Red Fleshed, T_8: L-49 × Red Fleshed, T_9: Doodh Khaja× Red Fleshed.

Table 2 : Bio-chemical characters of fruit

Treatments	TSS (°Brix)	Titratable acidity (%)	TSS: Acid ratio	Total sugar (%)	Reducing sugar (%)	Ascorbic acid (mg 100g^{-1})
T_1	10.50	0.32	32.81	6.98	4.75	117.00
T_2	8.33	0.30	27.77	6.20	4.20	120.90
T_3	9.20	0.33	27.88	6.38	4.31	118.30
T_4	8.70	0.29	30.00	6.41	4.24	114.40
T_5	8.10	0.35	23.14	6.20	4.17	113.10
T_6	10.57	0.30	35.23	6.98	4.82	136.50
T_7	11.03	0.36	31.38	7.11	4.90	138.67
T_8	9.93	0.33	30.09	6.58	4.48	143.00
T_9	9.80	0.33	29.69	6.49	4.35	130.87
SEm(±)	**0.10**	**0.03**	**0.42**	**0.07**	**0.04**	**1.05**
LSD (0.05)	**0.31**	**N/S**	**1.26**	**0.22**	**0.11**	**3.17**

*T_1: Allahabad Safeda, T_2: Baruipur, T_3: L-49, T_4: Doodh Khaja, T_5: Red Fleshed, T_6: Allahabad Safed × Red Fleshed, T_7: Baruipur × Red Fleshed, T_8: L-49 × Red Fleshed, T_9: Doodh Khaja× Red Fleshed.

Total sugar percentage

Data presented in Table 2 showed that total sugar percentage was recorded highest in T_7 (Baruipur × Red Fleshed) 7.11%, which was also statistically at par with T_1 (Allahabad Safeda) 6.98% and T_6 (Allahabad Safeda × Red Fleshed) 6.98% whereas lowest sugar percentage was found in T_2 (Baruipur) 6.20% and T_5 (Red Fleshed) 6.20%. Similar result was observed by Adress *et al*. (2010) where maximum total sugar (6.36%) was observed in cultivar Hong Kong.

Reducing sugar percentage

Reducing sugar was highest in T_7 (Baruipur × Red Fleshed) 4.90% followed by T_6 (Allahabad Safeda × Red Fleshed) 4.82% whereas lowest was observed in T_5 (Red Fleshed) 4.17% (Table 2). The finding was similar with Kumar *et al.* (2017) where reducing sugar content was maximum in Kayamganji (4.55%) followed by KG-1 (4.28%) and minimum reducing sugar were found in MPUAT Sel-2 (2.63%).

Ascorbic acid content (mg per 100g fruit weight)

Ascorbic acid content is maximum in T_8 (L-49 × Red Fleshed) 143.00 mg $100g^{-1}$ pulp followed by T_7 (Baruipur × Red Fleshed) 138.67 mg $100g^{-1}$ pulp and minimum in T_5 (Red Fleshed) 113.10 mg $100g^{-1}$ pulp (Table 2). The findings were similar with Sahoo *et al*. (2017) where the maximum ascorbic acid was reported in variety L-49 (154.67 mg $100g^{-1}$ fruit pulp in ambe-bahar fruiting (rainy season) and 226.00 mg $100g^{-1}$ fruit pulp in mrig-bahar fruiting (winter season). Kumar *et al*. (2017) reported maximum ascorbic acid in Sangareddy (149.41 mg $100g^{-1}$) followed by CISH-G-35 (145.39 mg $100g^{-1}$) and minimum was reported in RCGH-11 (84.47 mg $100g^{-1}$).

CONCLUSION

Most of the cases hybrids showed better result over their mother plant T_9 (Doodh Khaja × Red Fleshed) has maximum value for the characteristics like fruit weight (231.36 g), fruit length (6.84 cm), fruit width (5.64 cm), seed weight (1.67 g) and fruit yield (17.38 kg $tree^{-1}$). Whereas T_7 (Baruipur × Red Fleshed) has highest TSS (11.03°B), acidity (0.36%), total sugar (7.11%), reducing sugar (4.90%), meanwhile maximum ascorbic acid content was found (143.00 mg $100g^{-1}$ pulp) in T_8 (L49 × Red Fleshed). In most of the cases F1 hybrids showed a better result as compare to its parents.

REFERENCES

Adrees, M., Younis, M. Farooq, U. and Hussain, K. 2010. Nutritional quality evaluation of different guava varieties. *Pak J Agri Sci.,* **47**(1)**:** 1-4.

Anonymous. 2022. National Horticulture Board. http://www.apeda.in Horticulture Statistics Division, Department of Agriculture, Coopn & Farmers Welfare. www.agricoop.gov.in.

Dolkar, D., Bakshi, P. Wali, V. K. Bhusan, B. and Sharma, A. 2014. Growth and yield attributes of commercial guava (*Psidium guajava* L.) cultivars under sub-tropical condition. *Indian J. Plant Physiol*., **19**(1)**:**79-80.

Jana, B. R., Munsi, P. S. and Manna, D. C. 2016. Fruit morphological characters of winter season guava under Eastern Plateau of India: Basis of commercial selection. *Int. J. Curr. Res*., **8**(06)**:** 32922-32927.

Kumar, J., Kumar, R. Tripathi, S. and Singh, V. P. 2017. Physico-chemical and morphological evaluation of guava (*Psidium guajava* L.) genotypes under Tarai conditions. *Hort Flora Res. Spectrum*., **6**(2)**:** 97-101.

Mehta, S. K., Singh, K. K. Jat, D. K. and Rana, D. K. 2016. Comparative studies of physico-chemical characteristics of various cultivars of guava (*Psidium guajava* L.) under sub-tropical valley condition of Garhwal Himalaya (Uttarakhand). *India Plant Arch*., **16**(1)**:** 361-364.

Mehta, S. K., Singh, K. Rana, D. K. Bhartwal, P. and Brahmanand. 2018. Evaluation of physico-chemical parameters of different varieties of guava (*Psidium guajava* L.) under sub-tropical condition of Garhwal Himalaya (Uttarakhand), India. *Int. J. Advanced Scientific Res. Management*, **I**: 88-91.

Patel, R. K., Maiti, C. S., Deka, B. C., Deshmukh, N. A. Verma, Y. K. and Nath, A. 2015. Physical and biochemical changes in guava (*Psidium guajava* L.) during various stages of fruit growth and development. *Int. J. Agric.,Environment & Biotechnol*., **8** (1)**:** 63-70.

Ranganna, S. 1979. Handbook of analysis and quality control of fruits and vegetables products, Tata Mc Graw Hill Publishers, Delhi.

Ray, P. K. 2002. Guava. In: Ray, P. K. (ed) *Breeding tropical and subtropical fruits. Springer*., pp 143–154. New Delhi.

Sanchez-Blanco, M. J., Morales M. A, Torrecillas, A. and Alarcon J. J. 1998. Diurnal and seasonal osmotic potential changes in lotus creticus plants grown under saline stress. *Plant Sci*., **136:** 1–10.

Sharma, A., Sehrawat, S. K. Singhrot, R. S. and Tele, A. 2010. Morphological and chemical characterization of *Psidium* species. *Not Bot HortAgrobot Cluj*., **38**(1)**:** 28-32.

Singh, A., Kumar, S. and Kulloli, R. N. 2016. Performance evaluation of guava (*Psidium guajava* L.) introductions in arid conditions of western Rajasthan. *Annals of Arid Zone*., **55**(1-2)**:**25-28.

Swaminathan, M. S., Siddique, E. A. and Sharma, S. D. 1972. Outlook for hybrid rice in India. In: Rice Breeding. IRRI, Los Banos. pp. 609-613.

Wei, H. 2008. Freezing tolerance and cold acclimation in guava *(Psidium guajava* L.). M Sc. thesis, IOWA State University, Ames, IOWA.