

Evaluation of Guava (*Psidium guajava* L.) Genotypes for Tree Morphology and Fruit characteristics

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ABSTRACT: Guava exhibit greater variability on the region-specific which could lead to discovers a significant genotype that are suitable for a particular area or region in terms of yield and quality parameter. The growth, yield and quality traits of 21 genotypes of guava (*Psidium guajava* L.) were evaluated during the winter season of 2018-19. Plant height was higher in G-12 (8.55 m) whereas, the minimum height was recorded in G-15 (2.50 m). The maximum North-South spread was recorded in genotype G-7 (8.30 m) but East-West spread was recorded in genotype G-2 (6.15 m). In visual observation of canopy shape, it was seen that out of the 21 genotypes, 2 genotypes were found erect type, 7 genotypes were semi spreading, and 12 genotypes were spreading type. There was no variation in bark colour and leaf colour in selected genotypes but number of leaves/30cm shoot and size varied. The result showed that the values of physical parameters viz. fruit length (9.0 cm), fruit width (8.04 cm), pulp percentage (98.35 per cent) and thickness of pulp (1.8 cm) were found maximum in genotype G-13. Thus, genotype G-13 was found superior over other genotypes which may be selected for further evaluation and recommendation.

Keywords: Guava, Morphology, Fruit Characteristics, Genotypes, Plant spread, Fruit length.

INTRODUCTION

Guava (*Psidium guajava* L.) is the most valuable cultivated species of the Myrtaceae family, popularly known as 'poor man's fruit' or 'apple of the tropics' (Nakasone and Paull 1998). It is native to tropical America and distributed in many tropical and subtropical countries (Morton, 1987). Guava fruit is commercially grown in India and other countries. It is popular due to its year-round availability, rich nutritional and medicinal value and affordable price, suitability for transportation, handling and consumer preference. It is the fifth most important fruit crop of India, occupying 3.38 per cent of the total area under fruit cultivation. The fruits are usually consumed directly as fresh and processed products. Fresh fruit pulp contains high amounts of vitamins specially vitamin C, potassium, and phosphorus as well as numerous antioxidants and dietary fibers (Flores *et al.*, 2015). It is widely grown all over the tropical and subtropical conditions. In India, a wide range of variability in guava is reported. Guava represents an excellent source of vitamin C, as well as calcium, zinc, phosphorus and iron (Singh, 2005). Furthermore, fruits, leaves, flowers, roots, bark and stems are used in medicinal applications (Gutierrez *et al.*, 2008; Kamath *et al.*, 2008). The bloom arises on the axis of new leaves in guava and the bearing happens on current season growth (Alves *et al.*, 2020). Guava requires an

annual rainfall of 1,000 to 2,000 mm with an optimum temperature of 23°C to 26°C, though it can withstand up to 46 °C (Radha and Mathew 2007). Guava is a perennial, evergreen shrub or small tree, the tree can reach (10 m) in height, with a spreading branches. Guava tree has perfect flowers with male and female parts in each flower; flowers are white, fragrant, 4 cm wide, borne singly or a few together at leaf axils. Fruit is round, oval and pear-shaped berry, growing up to 5.0-12.5 cm length. The fluctuation in fruit weight during harvesting may be due to inherent traits and environmental adaptability in a given region, thereby indicating a crucial attribute for genotype selection (Singh *et al.*, 2022). Majority of the variability in guava populations is due to the seedling origin. They are variable in fruit (both pulp and peel), pulp thickness, numbers of seed and other morphological traits also reported from different regions. The studies on guava genotypes would further help in identification of potential parent genotypes for effective utilization in future breeding programme. Studies focusing on characterization of wild species and local cultivars is still lacking in Indian breeding programme, plays a significant role for further crop improvement.

MATERIAL AND METHODS

The present investigation was carried out at Fruit Research Station, Imalia, Department of Horticulture, College of Agriculture, Jawaharlal Nehru Krishi

Vishwa Vidyalaya, Jabalpur (MP) during July to December 2018. During the study, 21 genotypes were selected from the existing genotype population for detailed study based on plant type, growth, leaf size, fruit characteristics and the rest were discarded. The selected genotypes were given accession number (G-1 to G-21). The data were statistically analysed by the method of analysis of variance using Randomized Block Design. All the treatments (genotypes) were replicated three times and one tree served as a unit of treatment in each replication. Twenty fruits were randomly harvested from each genotype/tree for recording observations. The tree morphological parameters of genotype were studied in terms of tree height, canopy spread – north-south and east-west, shape of canopy and bark colour, leaf characters of leaves per 30 cm, leaf length, leaf breadth and leaf colour. Physical parameters of fruits regarding Fruit length, fruit width, number of seeds per fruit, seed size and seed hardness (at harvest) of fruits were recorded. Screening of guava seedlings was undertaken to select the superior type for further study and multiplication. Genotypes selected from the existing population and plants were tagged to study the tree's morphological and fruit characteristics. All the observations were recorded using standard procedure.

RESULTS AND DISCUSSION

Plant Characteristics. The maximum tree height was recorded in genotype G-12 (8.55 m) followed by G-10 (7.10 m) whereas; the minimum height was recorded in G-15 (2.50 m). The variability in growth due to genetic makeup of genotypes which developed through open pollinated seed. On the other hand, soil and micro-climate of the region also contributed in expressing the inherent characters of different genotypes. The habit of tree growth and their use for vegetative growth are important diagnostic characters for selection of genotypes as reported by Singh *et al.* (1976); Singh and Khan (1989).

In visual observation, it was seen that out of the 21 genotypes, 2 genotypes were found erect type, 7 genotypes were semi spreading and 12 genotypes were spreading type. The maximum North-South spread was recorded in genotype G-7 (8.30 m) followed by G-10 (7.50 m) and G-12 (6.80 m) respectively whereas, the minimum spread of North-South was recorded in G-16 (2.55 m). It is also obvious that the maximum East-West spread was recorded in genotype G-2 (6.15 m) followed by G-11 (5.95 m) and G-9 (5.65 m) respectively whereas; the minimum spread of East-West was recorded in G-21 (3.45 m). The growth habit is governed by genetic characters as well as the effect of agro-climatic conditions of the region. Subramanyam and Dinesh (1993) also recognized variation in growth habit in different cultivars of guava. He reported that the maximum East-West plant spread in Banarasi Whereas, North-South spread was more in Baumount. The Apple coloured had minimum spread in both directions. The selected 2 genotypes were erect, 7 genotypes were semi-spreading and the remaining 11 genotypes are spreading type. As a consequence of

genetic makeup of genotypes showed variability under different locations. The results are in agreement with Pandey *et al.* (1997); Sharma *et al.* (1998). No variation was noticed amongst the genotypes in terms of bark colour and leaf colour. The bark colour of all genotypes was light brown. This shows that there was no more variation was observed in all genotypes regarding bark colour. No variation was noticed amongst the genotypes in terms of bark colour and leaf colour. The reason may be due to close relation of the same species.

Leaf characteristics. The maximum number of leaves (27) per 30cm shoot length of tagged branch was found in genotype G-11 followed by G-5, G-13 and G-20 (26) respectively whereas, minimum was observed in G-4(15). Among all the genotypes, the maximum leaf length in tagged branch was found in G-19 (11.83 cm) followed by G-18 (11.80cm) whereas, minimum leaf length was found in G-7 (5.70 cm). The maximum leaf breadth (5.16 cm) was noted in genotype G-17 followed by G-18 and G-19 (5.13 cm) whereas, minimum leaf breadth was found in G-7(3.43 cm). Variation of plant growth characters in different cultivars is genetic feature of individual genotype. The results agree with Bangali *et al.* (1993). The soil and microclimatic conditions also added in exhibiting the inherent characters of different varieties. The results agree with Pandey *et al.* (1997); Sharma *et al.* (1998). The colour of Leaves in all genotypes were light green which shows that there was no more variation observed among genotypes regarding leaf colour.

Physical characteristics: The fruit length ranged from 4.87 to 9.00 cm and the maximum fruit length was recorded in G-13 (9.00 cm) followed by G-18 (8.7 cm) and G-11 (7.3 cm) respectively while minimum fruit length was recorded in G-3 (4.87 cm). The fruit width ranged from 5.15 to 8.04 cm but the maximum fruit width was noted in G-13(8.04 cm) followed by G-18 (7.64 cm) and G-14 (7.54 cm) respectively. While the minimum fruit width was recorded in G-3 (5.15 cm) presenting remarkable differences in the selected genotypes. The other factor controlling the fruit growth is the availability and supply of auxins that is translocated from pollen grains to developing ovules. Although the size of the fruit is a varietal character, it may be to some extent influenced by the total number of fruits born on the tree, soil moisture, source sink relation and other factors. Varietal variations for physical characters have also been reported by Dolkar *et al.* (2014); Jana *et al.* (2014); Verma and Singh (2015); Mehta *et al.* (2016).

The investigation revealed that maximum number of seeds (321) per fruit was found in genotype G-13 followed by G-14 (221) and G-17 (199) respectively, while the minimum number of seeds per fruit (61) was found in G-11. Dolkar *et al.* (2014) reported that highest numbers of seeds per fruit was in Arkaamulya and lowest seed number was observed in Lalit. The above findings are also supported by the results of Mahour *et al.* (2012) and he reported that Allahabad Safeda and Lucknow-49 was superior as compared to other varieties in relation to different physico-chemical parameters of fruit. The other varieties i.e. Rewa-72, Dharidar, Apple colour and Gwalior-27 was also

superior in some of the characters as compared to the other varieties. In all genotypes under this investigation, it was observed that out of 21 genotypes, 11 genotypes had bold seed and 10 genotypes had small seeds. Under this investigation, it was found that out of 21 genotypes, 8 genotypes had hard seeds, 8 genotypes had semi hard seeds and 5 genotypes had soft seeds.

Fruit weight ranged from 79.33 to 232.25 gm. The maximum average fruit weight (232.25 gm) was found under G-13 followed by G-20 (226.38 gm) and G-14 (203.38 gm) respectively whereas, the minimum fruit weight found in genotype G-4 (79.33 gm). The variation amongst the genotypes as regard average fruit weight ranged from 79.33 gm (G-4) to 232.25 gm (G-13) might be due to inherent characters and climatic adaptability in a particular region which may prove an important diagnostic character for selection of genotypes. The highest fruit weight was observed in cv. L-49 (235.50 gm) followed by Allahabad Safeda (210 gm) as reported by Kumar *et al.* (2006). Haji *et al.* (2012) also reported that the fruits during winter season showed significantly higher fruit weight as compared to the rainy season fruits. The fruit size and fruit weight were gradually increased from summer to rainy season and thereby winter season as reported by Jana *et al.* (2014) which is close to the conformity of the findings. The pulp percentage of different genotypes ranged from 96.90 to 98.35 per cent but genotype G-13 (98.35 per cent) had higher pulp percentage followed by G-

11(98.20 per cent) whereas, lower pulp percentage was recorded in G-14 (96.90 per cent). Kumar *et al.* (2006) reported that the highest pulp per cent (96.55 per cent) in genotype GRS-4. The pulp thickness of different genotypes ranged from 0.7 to 1.8 cm and the maximum pulp thickness was recorded with G-13, G-18 (1.8 cm) followed by G-11, G-16 (1.5 cm) whereas, minimum pulp thickness was recorded in G-4, G-8, G-20 (0.7 cm). 7 genotypes were had white pulp and 14 genotypes were had creamish white pulp colour. 2 genotypes were had green, 9 genotypes were had yellowish green and 10 genotypes were had light green fruit colour. Variability in visual characteristics of fruits may be due to their genetic makeup and phenotypic expressions that are influenced by local climatic conditions as well as micro climatic conditions. 21 genotypes, it was observed that 10 genotypes had light green fruit colour, 2 genotypes had green fruit colour and 9 genotypes had yellowish green fruit colour.

Correlation Studies: Correlation studies revealed that increase in one variable cause either increase or decrease in other variable. Thus, the positive associations in the study exhibit that fruit length, width, number of seeds per fruit, pulp thickness and pulp percentage had positive association with fruit weight. This indicates that if the fruit length, width, number of seeds per fruit, pulp thickness and pulp per centage is increase the fruit weight is also increase. Agrawal (2010). Exact same outcomes as Pandey *et al.* (2002).

Table 1: Morphological parameters of genotypes (Tree height, Canopy spread – North-South and East-West, Shape of canopy and Bark colour).

Genotypes	Tree Height (m)	Canopy Spread(m)		Shape of Canopy	Bark Colour
		N-S	E-W		
G1	3.10	3.20	4.55	Spreading	Light Brown
G2	6.20	6.50	6.15	Semi Spreading	Light Brown
G3	7.00	5.45	4.50	Semi Spreading	Light Brown
G4	5.70	4.25	4.95	Spreading	Light Brown
G5	4.40	3.80	4.30	Semi Spreading	Light Brown
G6	6.00	5.25	4.75	Semi Spreading	Light Brown
G7	6.30	8.30	5.25	Semi Spreading	Light Brown
G8	5.85	5.70	5.30	Erect	Light Brown
G9	6.25	5.00	5.65	Spreading	Light Brown
G10	7.10	7.50	6.10	Erect	Light Brown
G11	6.90	6.25	5.95	Semi Spreading	Light Brown
G12	8.55	6.80	5.60	Spreading	Light Brown
G13	4.65	5.00	4.00	Spreading	Light Brown
G14	5.30	4.40	4.15	Semi Spreading	Light Brown
G15	2.50	3.00	3.50	Spreading	Light Brown
G16	3.70	2.55	3.85	Spreading	Light Brown
G17	5.90	4.80	4.65	Spreading	Light Brown
G18	3.50	3.15	3.80	Spreading	Light Brown
G19	4.10	3.40	3.95	Spreading	Light Brown
G20	3.45	3.20	3.80	Spreading	Light Brown
G21	3.60	3.35	3.45	Spreading	Light Brown

N-S Canopy Spread North- South; E-W Canopy Spread East-West

Table 2: Morphological parameters of genotypes (Leaf Characters-Number of leaves per 30 cm length of shoot, Leaf length, Leaf breadth and Leaf colour).

Genotypes	Leaf Characters			
	No. of leaves per 30cm length of shoot	Leaf length(cm)	Leaf breadth(cm)	Leaf colour
G1	24	9.33	4.86	Light green
G2	22	8.63	4.20	Light green
G3	16	7.83	4.00	Light green
G4	15	7.73	4.73	Light green
G5	26	9.76	4.23	Light green
G6	19	9.86	4.53	Light green
G7	23	5.70	3.43	Light green
G8	25	8.30	4.73	Light green
G9	23	8.66	4.20	Light green
G10	17	8.46	4.16	Light green
G11	27	8.63	4.50	Light green
G12	24	11.63	5.03	Light green
G13	26	9.16	4.23	Light green
G14	17	8.73	4.36	Light green
G15	25	9.26	4.40	Light green
G16	23	7.86	4.26	Light green
G17	24	10.13	5.16	Light green
G18	22	11.80	5.13	Light green
G19	20	11.83	5.13	Light green
G20	26	11.26	4.40	Light green
G21	24	11.73	4.80	Light green

Table 3: Physical parameters of Guava fruits: Fruit length, fruit width, number of seeds fruit⁻¹, seed size and seed hardness (at harvest) of fruits.

Genotypes	Fruit length (cm)	Fruit width (cm)	Number of seeds fruit ⁻¹	Seed size	Seed hardness
G1	5.56	5.78	87	Small	Semi-hard
G2	5.44	5.56	168	Bold	Hard
G3	4.87	5.15	149	Bold	Hard
G4	5.51	5.57	125	Bold	Hard
G5	5.94	5.41	96	Small	Semi-hard
G6	5.51	5.57	179	Small	Semi-hard
G7	5.11	5.28	140	Bold	Soft
G8	5.91	6.15	185	Small	Semi-hard
G9	5.87	5.82	182	Small	Semi-hard
G10	5.06	5.35	163	Small	Soft
G11	7.30	6.74	61	Bold	Hard
G12	5.71	5.88	117	Bold	Hard
G13	9.00	8.04	321	Bold	Hard
G14	7.00	7.54	221	Small	Semi-hard
G15	6.81	6.90	188	Bold	Hard
G16	6.31	5.84	148	Small	Soft
G17	6.23	6.65	199	Bold	Hard
G18	8.70	7.64	186	Bold	Semi-hard
G19	5.93	6.15	132	Bold	Semi-hard
G20	6.35	6.37	104	Small	Soft
G21	6.50	5.74	151	Small	Soft

Table 4: Average fruit weight (gm), pulp percentage (%), pulp thickness (cm), pulp colour and Fruit colour.

Genotypes	Average fruit weight (gm)	Pulp percentage (%)	Pulp thickness (cm)	Pulp colour	Fruit colour
G1	134.75	97.99	1.3	White	L.G.
G2	88.35	97.54	1.4	C.W.	L.G.
G3	110.61	97.59	0.9	White	Y.G.
G4	79.33	98.00	0.7	White	L.G.
G5	95.28	97.53	1	C.W.	Y.G.
G6	85.90	97.10	1.1	C.W.	L.G.
G7	130.75	97.88	1.2	White	L.G.
G8	113.04	97.81	0.7	White	L.G.
G9	121.15	97.47	1	C.W.	Y.G.
G10	109.20	97.98	1.1	C.W.	Y.G.
G11	194.42	98.20	1.5	C.W.	Y.G.
G12	148.07	97.21	0.9	White	L.G.
G13	232.25	98.35	1.8	C.W.	Y.G.
G14	203.38	96.90	1	C.W.	L.G.
G15	195.28	97.05	1	C.W.	Y.G.
G16	197.66	97.46	1.5	C.W.	Y.G.
G17	199.34	96.94	1.3	White	Y.G.
G18	201.00	97.71	1.8	C.W.	Green
G19	200.34	98.07	1.1	C.W.	Green
G20	226.38	98.04	0.7	C.W.	L.G.
G21	200.20	97.48	1.3	C.W.	L.G.

C.W.-Creamish white; L.G.- Light green; Y.G.- Yellowish green

Table 5: Zero order simple correlation among physical parameters of fruits.

Characters	Fruit length	Fruit width	Number of seeds fruit ⁻¹	Average fruit weight	Pulp percentage	Pulp thickness
Fruit length	1.000					
Fruit width	0.918**	1.000				
Number of seeds fruit ⁻¹	0.486*	0.567**	1.000			
Average fruit weight	0.725**	0.745**	0.237	1.000		
Pulp percentage	0.145	0.003	-0.183	0.051	1.000	
Pulp thickness	0.636**	0.466*	0.323	0.430	0.178	1.000

*Significant at 5% level of probability; ** Significant at 1% level of probability

CONCLUSIONS

Based on result, it is noted that G-12 recorded maximum plant height (8.55 m), whereas; the minimum height was recorded in G-15 (2.50 m). The maximum North-South spread was recorded in genotype G-7 (8.30 m) but East-West spread was recorded in genotype G-2 (6.15 m). As far as physical parameters are concerned the maximum fruit length (9.0 cm), fruit width (8.04 cm), pulp percentage (98.35 per cent) and thickness of pulp (1.8 cm) were found in genotype G-13. Thus, genotype G-13 was found superior over other genotypes which may be selected for further evaluation and recommendation. In visual observation of canopy shape, it was seen that out of the 21 genotypes, 2 genotypes were found erect type, 7 genotypes were semi spreading and 12 genotypes were spreading type. The variability in these selected genotypes may be due to genetic makeup and agro-climatic conditions of the locality.

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