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STUDIES ON GROWTH PARAMETERS AND FRUIT CHARACTERS IN GUAVA (*Psidium guajava* L.) GENOTYPES OF CHHATTISGARH PLAINS

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ABSTRACT

Eighteen guava genotypes were evaluated during year 2016-17 on the basis of tree morphology, fruit characters and yield through survey of Bilaspur and Garyiband Districts of Chhattisgarh State, India. Physical characters of tree and fruit vary significantly among different guava genotypes. The maximum tree height was reported in RJMG-9 while, the highest number of fruits was observed in RJMG-4. In respect of fruit traits, maximum fruit length, fruit width and maximum weight of nonedible waste was recorded in BSPG-1 whereas, maximum fruit weight, pulp weight and pulp thickness was noted in RJMG-1. Significantly minimum seed weight and number of seeds were recorded in RJMG-3. From the investigation, it is inferred that genotypes BSPG-1, RJMG-1 and BSPG-8 were superior to other genotypes in relation to different yield and quality parameters of fruits.

(Key words: Guava', genotypes, fruit, tree, weight)

INTRODUCTION

Guava is one of the most important commercial fruit crops of India. It has earned the popularity as "Poorman's apple" available in plenty to every person at very low price during the season. It excels most of the other fruit crops in productivity, hardiness and adaptability. Guava fruit contains high amounts of Vitamins A, B_1 (Thiamin), B_2 (Riboflavin) and C (70-350 mg 100 g^{-1} of pulp). The vitamin C content of guava fruit is 2–5 times more than citrus (Singh, 2003). In India, guava occupies an area of 2.51 Lakh ha and production of 40.83 Lakh M.T. with productivity of 16.3 M.T. ha^{-1} (Anonymous, 2016). Its cultivation is common in India, which is concentrated mainly in Uttar Pradesh, Bihar, Madhya Pradesh, Maharashtra and Chhattisgarh. It is widely distributed with the highest productivity in M.P. (Anonymous., 2016). Chhattisgarh covered an area of 0.21 Lakh ha and annual production of 1.74 Lakh M.T. with productivity of 8.56 M.T. ha^{-1} (Anonymous, 2016).

Majority of the variability of guava populations is due to the seedling origin, they are variable in fruit colour (both pulp and peel), pulp thickness, number of seeds and other morphological and quality characters are also reported from different regions. Hence, there is a great potential for the application of characterization of tropical fruit crops like guava. Guava being a cross-pollinated crop has large variability in size of fruit as well as the colour of pulp. This natural variability available within the species is often exploited to identify superior genotypes. Chhattisgarh plains have availability of lines of guava and exist in the form of land races, hence, there exists a lot of scopes to identify best one amongst wild strains available in plenty. Therefore, the present study was undertaken for selection and characterization based on the *in-situ* performance of guava genotypes in Chhattisgarh plains.

MATERIALS AND METHODS

The two districts of Chhattisgarh State of India were selected for a survey of superior guava genotype during the year 2016-17. Different genotypes were chosen by collecting the information from local people. On the basis of survey guava orchards of two locations *i.e.* Kodasar Village of Takhatpur Block, District Bilaspur and Chandrasur Village of Magarlod Block, District Gariyaband were selected for the present study. Only 8-10 years old genotypes were identified for this study. Bilaspur and Gariyaband districts comes under Chhattisgarh plains, districts have climatic condition viz., dry, sub-humid agro-climatic region. Experiment location of Kodasar, Bilaspur district is situated between 22.09° North Latitudes and 82.15° East Longitudes and Chandrasur, Dhamtari District is situated in the central part of Chhattisgarh and lies 20.63° North Latitude and 82.05° East longitude.

Thirteen parameters of tree and fruit were included for the study (tree height, trunk girth, canopy spread,

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number of fruits tree^{-1}, fruit yield plant^{-1}, fruit weight, fruit length, fruit width, weight of non edible waste, pulp weight, pulp thickness, number of seeds fruit^{-1} and seed weight). The spread of the tree was measured in meter in both the directions i.e. North-South and East-West and their mean was recorded. All observations on the fruit and its related parts were made at the matured to optimum ripening stage. The physical observations on fruit diameter, fruit length, fruit weight, pulp colour and fruit colour were recorded. The upper and basal non-edible portion of individual fruit was removed and weighed separately on an electronic balance and an average weight of non-edible waste was recorded in grams. The experiment was laid out in randomized block design (RBD). All the treatments (genotypes) were replicated three times and one tree served as a unit of treatment in each replication. Thirty fruits were randomly harvested from each genotype (tree) for recording observations. The data on different parameters were analyzed by using analysis of variance (ANOVA) by using Statistical Package using online OP Stat software.

RESULTS AND DISCUSSION

It is evident from the data presented in table 1, that tree height varied among different genotypes. The maximum tree height (4.43 m) was recorded in genotype RJMG-9 followed by genotypes BSPG-8 (4.40 m) and BSPG-3 (4.30 m) whereas, the minimum tree height (3.50 m) was recorded in genotype RJMG-6 followed by genotypes RJMG-2 (3.55 m) and BSPG-6 (3.60 m). The maximum trunk girth (55.44 cm) was recorded in genotype BSPG-8 followed by genotypes BSPG-3 (55.32 cm) and RJMG-9 (53.66 cm) whereas, the minimum trunk girth (39.25 cm) was recorded in genotype RJMG-6 followed by genotypes RJMG-2 (40.13 cm) and BSPG-6 (40.33 cm). As a consequence of the genetic makeup of selected genotypes, they showed variability under different locations. The soil and microclimatic conditions also added in exhibiting the inherent characters of different genotypes moreover, these genotypes have been developed from different ecological zones of the Chhattisgarh. The presence of strong apical dominance in genotypes RJMG-9, BSPG-8 and BSPG-3 may be attributed to maximum tree height. Similar results were obtained in guava by Singh *et al.* (2011) and Ulemale and Tambe (2015) in guava, who reported maximum tree height and trunk girth in Allahabad Safeda and genotype GRS4 respectively.

The maximum plant spread in North-South direction was observed in genotype RJMG-3 (7.78 m) followed by genotypes BSPG-3 (7.43 m) and BSPG-8 (7.33 m) whereas, minimum plant spread in North-South direction was observed in genotype BSPG-9 (5.11 m) followed by genotypes RJMG-5 (5.14 m) and RJMG-9 (5.43 m). The maximum plant spread in East-West direction was observed in genotype RJMG-4 (7.84 m) followed by genotypes RJMG-7 (7.55 m) and RJMG-1 (7.37 m) whereas, minimum plant spread in East-West direction was observed in genotype BSPG-6 (5.10 m) followed by genotypes BSPG-9 (5.30 m) and RJMG-3 (5.38 m). The canopy spread might be due to the difference in inherent characters of germplasm located under different agro-climatic conditions as well as the management practices and age of the tree. Similar results were reported by Pandey *et al.* (2016) in guava with maximum (7.53 m) E-W canopy spread in Hybrid-21.

The maximum number of fruits plant^{-1} was observed in the genotype RJMG-4 (121) followed by genotypes BSPG-3 (106) and RJMG-3 (102) whereas, the minimum number of fruits plant^{-1} was found in the genotype BSPG-6 (55) followed by genotypes BSPG-9 (58) and RJMG-5 (61). The variation among the genotypes as regards number of fruits plant^{-1} might be due to genetic variation, inherent characters, soil condition and climatic adaptability in a particular region, which might prove an important diagnostic character for selection of genotypes for local condition. In many genotypes, number of fruits increased but fruit yield decreased. This might be due to distribution and diversion of available food material in more number of fruits. Similar results were reported by Singh (2003) in guava with highest number of fruits plant^{-1} (402.16) in Chittidar followed by Red Fleshed (342.116 fruits plant^{-1}).

The data presented in table 1 indicated a wide variation in fruit yield recorded among different genotypes. The highest fruit yield plant^{-1} was observed in the genotype RJMG-1 (21.32 kg) followed by genotypes BSPG-2 (20.81 kg) and BSPG-1 (18.92 kg) whereas, lowest yield plant^{-1} found in the genotype BSPG-6 (8.16 kg) followed by genotypes BSPG-9 (9.70 kg) and BSPG-5 (10.07 kg). The significant variation in yield tree^{-1} was reported in present study. Although the size of the fruit is having varietal character, it may be up to some extent influenced by the total number of fruits born on the tree, age of the tree, soil moisture, source-sink relation and other factors (Ghosh and Chhattopadhyay, 1996). However, higher yield in genotypes RJMG-1 and BSPG-2 may be due to a maximum spread of the tree produced more number of fruits tree^{-1} with the greater size of fruits. The result is in agreement with the earlier worker Babu *et al.* (2007) in guava, who reported highest productivity in Allahabad Safeda (20.40 kg tree^{-1}).

The data from table 2 revealed that fruit length and fruit width ranged from 6.23 to 7.84 cm and 6.41 to 7.66 cm respectively. The maximum fruit length and fruit width were observed in genotype BSPG-1 (7.84 cm and 7.66 cm) which were found to be *at par* with genotypes RJMG-1, BSPG-8, RJMG-8 and RJMG-9 whereas, minimum fruit length and fruit width were observed in genotypes BSPG-3 (6.23 cm and 6.42 cm) and RJMG-4 (6.54 cm and 6.41 cm) respectively. Generally, the size of the fruit is having variable character, but to some extent influenced by the crop load on the tree, a number of fruits tree^{-1}, soil moisture status, fertility status, source-sink relation and other factors. These findings are in agreement with the work of Patel *et al.* (2007), who reported that genotype L-49 was found better in fruit length (6.56 cm) and fruit diameter (6.91 cm) whereas, Pandey *et al.* (2016) reported maximum fruit length in Hybrid-21 (8.08 cm).

Table 1. Growth and yield parameters of *in-situ* guava genotypes

Genotypes	Tree height (m)	Trunk girth (cm)	Canopy spread N-S (m)	Canopy spread E-W- (m)	Number of fruits tree^{-1}	Fruit yield plant^{-1} (kg)
BSPG-1	3.66	42.15	6.10	6.55	89	18.92
BSPG-2	3.80	44.25	7.32	5.98	96	20.81
BSPG-3	4.30	55.32	7.43	5.80	106	13.78
BSPG-4	3.90	45.45	5.66	6.10	71	13.95
BSPG-5	3.70	42.10	6.03	5.47	66	10.07
BSPG-6	3.60	40.33	5.45	5.10	55	8.16
BSPG-7	4.10	51.26	5.76	6.20	62	11.05
BSPG-8	4.40	55.44	7.33	5.66	98	18.01
BSPG-9	4.00	47.15	5.11	5.30	58	9.70
RJMG-1	3.95	45.55	5.93	7.37	93	21.32
RJMG-2	3.55	40.13	6.55	5.36	86	13.33
RJMG-3	4.05	48.20	7.78	5.38	102	17.77
RJMG-4	3.85	45.10	5.90	7.84	121	15.94
RJMG-5	3.94	47.00	5.14	5.77	61	10.94
RJMG-6	3.50	39.25	6.77	5.49	91	14.80
RJMG-7	4.15	53.22	6.23	7.55	95	17.87
RJMG-8	3.76	44.13	6.38	5.44	82	12.24
RJMG-9	4.43	53.66	5.43	6.12	74	13.40
Range	3.50-4.43	39.25-55.44	5.11-7.78	5.10-7.84	55-121	8.16-21.32
Mean	3.92	46.64	6.23	6.02	83.66	14.55

Table 2. Physical parameters (Fruit weight, Weight of non-edible waste, Pulp weight, Seed weight and Number of seeds per fruit) of *in-situ* guava genotypes

Genotypes	Fruit length (cm)	Fruit width (cm)	Fruit weight (g)	Weight of non-edible waste (g)	Pulp weight (g)	Pulp thickness (cm)	Seed weight (g)	Number of seeds fruit^{-1}
BSPG-1	7.84	7.66	212.67	3.81	188.04	1.94	3.26	253.67
BSPG-2	7.25	7.49	216.81	3.41	191.59	1.89	3.14	273.00
BSPG-3	6.23	6.42	130.00	3.21	112.33	1.54	3.17	277.67
BSPG-4	7.19	6.66	196.41	3.24	176.24	1.69	2.89	242.33
BSPG-5	7.04	6.88	152.59	3.05	134.33	1.41	3.54	321.67
BSPG-6	7.00	7.13	148.30	3.16	132.75	1.51	3.32	286.67
BSPG-7	7.23	7.08	178.14	3.34	161.22	1.63	3.40	333.67
BSPG-8	7.36	7.22	183.80	3.14	162.00	1.55	2.67	233.00
BSPG-9	6.97	6.59	167.31	3.08	148.30	1.56	2.53	214.33
RJMG-1	7.72	7.53	229.17	3.79	205.55	1.98	3.00	254.67
RJMG-2	7.17	6.86	155.11	3.07	134.25	1.47	2.80	268.67
RJMG-3	7.26	7.17	174.25	3.26	151.18	1.64	2.32	177.00
RJMG-4	6.54	6.41	131.80	3.33	113.00	1.39	2.95	246.00
RJMG-5	7.07	7.15	179.37	3.22	160.51	1.59	3.09	270.67
RJMG-6	6.99	7.12	162.66	3.19	140.76	1.42	2.90	256.00
RJMG-7	7.23	7.11	188.21	3.35	167.33	1.66	3.70	346.67
RJMG-8	7.31	7.17	149.32	3.37	132.66	1.58	2.64	210.67
RJMG-9	7.29	7.19	181.17	3.43	164.21	1.72	3.34	327.67
S Em±	0.19	0.19	8.03	0.12	8.33	0.08	0.12	11.06
C D at 5 %	0.57	0.55	23.20	0.34	24.02	0.24	0.36	31.94

The maximum fruit weight was noticed under genotype RJMG-1 (229.17 g), which was found to be *at par* with genotypes BSPG-2 (216.81 g) and BSPG-1 (212.67 g) whereas, the minimum fruit weight was observed in genotype BSPG-3 (130 g) followed by genotypes RJMG-4 (131.80 g) and BSPG-6 (148.30 g). The higher fruit weight in genotypes RJMG-1, BSPG-2 and BSPG-1 might be due to less number of fruits tree^{-1} and high canopy volume, which leads to the high diversion of food material to the optimum number of fruits to attain good size. The variation in fruit weight is also due to tree character as well as the ecological behaviour of location. Similar results were obtained by Singh (2003) with L-49 fruits and Patel *et al*. (2005) in Dharidar.

The maximum weight of non-edible waste was noticed under genotype BSPG-1 (3.81 g) which was found to be *at par* with genotype RJMG-1 (3.79 g) whereas, the minimum weight of non-edible waste was observed in genotype BSPG-5 (3.05 g) followed by genotypes RJMG-2 (3.07 g) and BSPG-9 (3.08 g). The higher weight of non-edible waste in genotypes BSPG-1 and RJMG-1 might be due to the maximum fruit weight of these genotypes with high peel thickness. Similar results were obtained by Choudhary (2004) with maximum weight of non-edible waste of guava fruits in Rewa-72 (5.25 g).

The maximum pulp weight was noticed under genotype RJMG-1 (205.55 g) which was *at par* with genotypes BSPG-2 (191.59 g) and BSPG-1 (188.04 g) whereas, the minimum pulp weight was observed in genotype BSPG-3 (112.33 g). The higher pulp weight might be due to higher fruit weight, fruit length, fruit width and a minimum number of seeds which contributes to high pulp content. These results are in agreement with Gohil *et al.* (2006), who reported Behat Seedless having highest pulp weight.

The pulp thickness of different genotypes ranged from 1.39 to 1.98 cm. The maximum pulp thickness was observed in genotype RJMG-1 (1.98 cm) which was found to be *at par* with genotypes BSPG-1 (1.94 cm) and BSPG-2 (1.89 cm) whereas, minimum pulp thickness was reported in genotype RJMG-4 (1.39 cm). The variation in pulp thickness might be due to the genetic behaviour of different genotypes with bigger or smaller sizes varies with weight. High pulp thickness in genotypes RJMG-1, BSPG-1 and BSPG-2 might be due to higher fruit weight and pulp weight with a low number of seeds in these genotypes. The present results are in close agreement with Patel *et al.* (2005) and Pandey *et al.* (2016) in guava, they reported highest pulp thickness in seedless cultivars.

The minimum seed weight (2.32 g) and number of seeds fruit^{-1} (177.00) were observed in genotype RJMG-3 (2.32 g) whereas, the maximum seed weight and number of seeds fruit^{-1} were observed under genotype RJMG-7 which was found to be *at par* with genotypes BSPG-5, BSPG-7 and RJMG-9. The composition of minimum seed weight, minimum pericarp weight and maximum pulp weight was a good criterion for selecting the superior genotypes. Minimum seed weight in genotypes RJMG-3, BSPG-9 and RJMG-8 might be due to minimum photosynthetic substances diverted towards seeds. The results are in accordance with the findings of Gohil *et al.* (2006) in guava, they found that number of seeds fruit^{-1} was highest in Sardar. The lowest number of seeds in genotype RJMG-3 might be due to high pulp per cent. Similar results were also obtained by Khehra and Bal (2006) in guava, who found minimum number of seeds in genotype ASR/RA-2. From the investigation, it is inferred that genotypes BSPG-1, RJMG-1 and BSPG-8 were superior to other genotypes in relation to different yield and quality parameters of fruits.

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