Performance of Exotic Guava (*Psidium guajava* L.) Germplasm in Humid Sub-Tropics of Meghalaya, India.

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Nine exotic accessions (USA) and two standard varieties of guava (Psidum guajava L.) from India were evaluated together for growth, yield and quality attributes under hilly land conditions (30-35% slope) in mid altitudes (1000m) of Meghalaya. Very high degree of variability (CV%) was recorded in respect to number of fruits and fruit yield/ tree. Acidity and fruit density followed by fruit weight and tree volume. Number of trees, fruit density, stem girth and tree volume and spread showed positive and significant correlation with yield/tree. All the 16 characters studied had significant differences among genotypes. Accessions No. EC-313009 and EC-313010, were found to be significantly high yielding accessions, with pink pulp and sour taste but showed poor quality. However, the yield performance of EC-313012 and EC-313013 was moderate but quality wise superior among all genotypes, thus identified as promising for mid altitude of Meghalaya.

Key Words : Ascorbic Acid, Correlation and Variability, Exotic Germplasm, Germplasm Evaluation, Growth and Yield, *Psidum guajava* L.

Guava (*Psidum guajava* L.) is one of the important fruit crops of North India. It is gaining popularity in hilly areas of North-Eastern Region, through productivity is lower in comparison with the Northern plains (Chandra and Govind, 1995). In low hilly situation of Meghalaya, it has been observed that fruit ripening during rainy season is delayed owing to cool temperature, causing fruits to ripen in October and November, which may be off season crop for Northern plains (Chandra and Govind, 1991; Chandra 1993). As far as the recommendation of varieties is concerned, very little efforts were made in Meghalaya (Chandra and Govind, 1991) and in Sikkim (Gurang and Sing, 1980.) among North eastern states. Considering the scope of guava in this region, the introduction of suitable genotypes and their evaluation programme was undertaken.

Materials and Methods

Nine exotic accessions received from USA were introduced during 1992 at the experimental farm of Regional Station of National Bureau of Plant Genetic Resources (NBPGR), Barapani. These were planted in a randomized block design with two checks namely Allahabad Safeda and Lucknow – 49, and replicated thrice . The experiment was laid on sloppy land (30-35% slope) at 1000m altitude above the sea level. Plantation was carried out on half moon terraces made along the contour lines with a distance of 5m between each plant. The soil consisted of loam (Typic Paleudolfs) with a pH of 4.6. The total rainfall ranged from 199.3-286.0 cm, temperature from 5.2-28.5 °C, humidity from 53.0-92.0% and sunshine duration from 2.04-8.47 hours during the period 1992-1996. Observations were recorded for different growth, yield and quality parameters.

Five ripe fruits from each tree were harvested for qualitative studies during first week of November 1996. Acidity and ascorbic acid in fruits were analyzed by standard procedures (Ranganna, 1997). The tree volume was calculated based on formula of Westwood *et al.*, (1963). Mean range of variation, coefficient of variation (CV%), standard deviation (SD) and correlation were also computed for various attributes.

Results and Discussion

Evaluation of guava genotypes showed considerable degree of variation in respect to their growth, yield and quality attributes (Table 1). The highest coefficient of variation (CV) was observed for number of fruits/tree (96.76%) followed by fruit yield/tree (86.66%), acidity (75.25%) and fruit density (71.87%) but it was lowest for TSS (9.01%). Since these characters have wider variability, they can be used to make selections in guava. Positive correlation of fruit yield/tree with number of fruits/tree (r-0.92) and fruit density (r-0.84) was observed to be highly significant (P/-0.01) whereas stem girth, tree spread and volume with fruit yield/tree showed positive correlation at 5% level of significance. Thus, these traits may be suitable entries while making selection from the population for higher yield.

The analysis of variance showed significant difference (P/-0.05) among genotypes for all the 16 characters studied (Table 2, 3 and 4). Plant height was 2.26-4.38 m

Table 1. Mean range, coefficient of variation (CV) and correlation for growth, yield and quality characters in guava germplasms (1996).

Character	Range	Mean	S.D.	CV%	r'
Plant height (m)	2.26-4.38	2.91	0.69	23.71	0.23
Stem girth (cm)	12.66-25.66	19.64	3.64	18.53	0.66*
Tree spread (m)	2.59-4.59	3.67	0.58	15.80	0.60*
Tree volume (m^3)	3.37-7.22	5.08	1.32	25.98	0.62*
Leaf length (cm)	8.23-12.06	10.03	1.27	12.66	0.06
Leaf width (cm)	3.50-5.60	4.67	0.62	13.28	0.57
No. of fruits/tree	12.01-342.0	104.09	98.08	96.76	0.92**
Fruit weight (g)	100.00-283.30	158.14	56.79	35.91	0.06
Fruit length (cm)	6.20-8.53	7.26	0.69	9.50	0.49
Fruit diameter (cm)	5.68-7.74	6.46	0.67	10.37	-0.10
Fruit density (No. of fruits/m^3 tree volume)	6.60-47.40	18.97	13.08	71.87	0.84**
Days to fruit maturity	104.30-190.0	156.90	26.60	16.95	0.02
Fruit yield/tree (kg)	5.80-57.23	18.14	15.72	86.66	-
T.S.S. (%)	8.10-11.10	9.43	0.85	9.01	-0.18
Acidity (%)	0.37-2.85	1.01	0.76	75.25	0.13
Ascorbic acid (mg/100g fruit pulp)	272.0-424.9	328.91	54.36	16.53	0.12

* Significant at 5 per cent;
** Significant at 1 per cent;
r correlation coefficient between fruit yield/tree and other characters.

Table 2. Morphological growth parameters of exotic guava accessions studied

Accession No./ Variety	Plant height (m)	Stem girth (cm)	Tree spread (m)	Tree volume (m^3)	Leaf length (cm)	Leaf width (cm)
EC-313009	3.51	25.66	4.59	7.22	9.30	5.10
EC-313010	3.31	24.00	4.25	6.36	11.73	5.60
EC-313012	2.48	20.50	2.59	3.49	9.93	4.80
EC-313013	2.48	12.66	2.90	3.56	8.23	4.30
EC-323712	3.60	17.16	3.76	5.55	9.10	3.50
EC-323713	2.86	22.53	4.23	5.96	12.06	5.33
EC-323714	2.26	17.93	3.52	4.40	10.20	4.50
EC-323715	4.38	20.00	3.72	6.33	10.93	4.73
EC-323716	2.33	17.16	3.38	5.16	8.50	3.96
Allahabad Safeda	2.35	20.55	3.73	4.50	11.00	4.73
Lucknow-49	2.47	17.93	3.76	3.37	9.43	4.56
C.D. (P=O.05)	0.43	6.80	0.43	0.59	1.91	0.22

in different genotypes with highest value of 4.38m in EC-323715. Plant spread was higher in EC-313009, EC-31310 and EC-323713. Their values ranged between 4.23-4.5 m, which indicates these genotypes are spreading type with semi-tall to tall growing in nature. Besides, their tree volume (5.96-7.22m) and stem girth (22.53=25.66m) were also higher. Leaf length and width of different genotypes varied between 8.23-12.06 cm and 3.50-5.60 cm respectively.

Fruiting was noticed in all the genotypes from 3rd year onwards after planting. Though number of fruits/ tree in 1995 was less (11.0-60) but in the subsequent year it was higher (36.7-342.0). EC-313009 (342.0) and EC-313010 (233.3) accessions recorded more number of fruits per tree during 1996. Heavy fruiting in guava after 2 year of planting was also recorded by Yadava (1996) in Fort Valley of Georgia. EC-313013 and EC-313022 were at par with each other and significantly superior to other genotypes in respect of their fruit weight and size. Average fruit weight ranged between 100.0-283g in different genotypes. Maximum fruit weight (283.3g) was noted in EC-313013, followed by EC-313012 (250.0g), while the fruit density was significantly highest in EC-313009 (47.4) followed by EC-313010 (36.7) and Lucknow-49 (21.9). It was lowest in EC-323712 (6.6).

In general, flowering started from April to May and depending upon the genotype, the fruit started ripening from August and continued till the last week of November. Moreover, the fruits in most of the genotypes were ready for harvest in between second week of October to first week of November. EC-323712 was the earliest genotype where fruit matures in about 100 day after flowering while in EC-323714 it took 190-198 days to mature (Table 3). Rathore (1976) and

Table 3. Yield attributing characters of exotic guava accessions

Accession/variety	No of Fruits/tree		Average fruit weight (g)	Fruit size (cm)		Fruit density (No. of fruits/ tree volume)	Days to maturity	
	1995	1996	1996	Length 1996	Diameter 1996	1996	1995	1996
EC-313009	33.0	342.0	145.0	7.8	6.2	47.4	153.3	154.7
EC-313010	60.0	233.3	146.7	7.4	6.3	36.7	130.3	138.7
EC-313012	35.3	44.0	250.0	8.1	7.7	12.6	160.0	155.3
EC-313013	27.3	42.0	283.3	8.5	7.7	11.8	168.3	165.3
EC-323712	26.3	36.7	143.3	6.3	6.1	6.6	101.7	104.3
EC-323713	11.0	91.0	149.3	7.8	5.9	15.3	184.7	184.3
EC-323714	20.3	51.3	140.0	6.9	6.2	11.7	198.3	190.0
EC-323715	22.7	64.0	102.0	6.2	5.7	10.1	160.0	153.3
EC-323716	31.0	86.3	136.7	6.7	6.3	16.7	181.0	193.7
Allahabad Safeda	36.7	80.3	143.3	6.7	6.6	17.9	129.6	130.7
Lucknow-49	25.6	73.7	100.0	7.1	6.4	21.9	153.0	155.7
CD (P=O.05)	19.2	23.5	51.6	0.5	1.0	6.4	10.3	18.4

Samson (1986) also reported that guava can take 100-150 days from bloom to fruit harvest depending upon its cultivar or type and ecological conditions. Fruit maturation periods in different genotypes were not much influenced by climatic conditions during 1995 and 1996 period.

Among the quality parameters, acidity was the variable character which could range from 0.37-2.85% in different genotypes (Table 4). The fruit of EC-323712 was the most sour in taste and had 2.85% acidity. In contrast EC-313013 was the sweetest genotype and had significantly higher TSS (11.1%) followed by Lucknow-49 (10.06%). Genotypes EC-313012 (409.43mg/100 g of pulp) and EC-313013 (424.93mg/100 g pulp) were significantly superior in ascorbic acid content. The ascorbic acid in fruits of different genotypes ranged between 272.00-424.93 mg/100 g of pulp. Yield performance of the accession EC-313009 was significantly superior followed by EC-313010 in both the years. The fruit yield varied from 3.16 to 23.46 kg/tree in 1995 and 5.80 to 57.23 kg/tree in 1996.

Out of 9 exotic germplasm, the flesh colour of fruits of 6 genotypes were pink and they were sour in taste with moderate to high yield performance. Thus, EC-313009 and EC-313010, having higher yield and pink colour, can be exploited for crop improvement and also for preparation of value added products. Although yield efficiency per unit volume of tree of EC-313012 and EC-313013 was comparatively lower to the standard varieties Allahabad Safeda and Lucknow-49) but their fruit weight and quality was superior to them. Besides the plant canopy stature was dwarf which proves better scope for high density planting in mid hills of Meghalaya.

Table 4. Fruit yield and quality characters of exotic guava gentoyses

Accession/ Variety	T.S.S. (%)	Acidity (%)	Ascorbic acid (mg/ 100g of pulp	Fruit yield/ tree (kg)		Flesh colour	Taste
	1996	1996	1996	1995	1996		
EC-313009	9.46	1.18	282.60	23.46	57.23	pink	sour
EC-313010	8.06	1.16	314.63	15.40	36.05	pink	sour
EC-313012	9.86	0.41	409.43	10.86	11.55	white	sweet
EC-313013	11.1	0.49	424.93	3.46	18.70	white	sweet
EC-323712	9.66	2.85	333.33	4.66	8.33	pink	sour
EC-323713	8,83	1.40	361.83	3.16	23.20	pink	sour
EC-323714	8.26	0.63	358.83	13,66	8,80	pink	sour
EC-323715	9.10	0.53	272.03	8.21	5.80	white	sweet
EC-323716	9.80	1.69	272.73	8.55	13.33	pink	sour
Allahabad Safeda	9,50	0.37	275.76	6.13	8.13	white	sweet
Lucknow-49	10.06	0.42	312.06	5.53	8.13	white	sweet
CD (P=O.05)	0.69	0.15	44.15	3.23	11.36	-	-

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