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Evaluation of newly developed guava cultivars & selections under Lucknow conditions

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ABSTRACT

The assessment of grafted plants of 10 guava selections & cultivars, *viz.*, Pant Prabhat, Lalit, Shweta, CISH-G-4, CISH-G-31, CISH-G-1, Arka Mridula, Hybrid-21, Arka Amulya, Hisar Surkha and Hisar Safeda was carried at the Central Institute of Subtropical Horticulture, Rehmankhera, Lucknow during 2011-12. Plant height was maximum in hybrid-21 (6.33 m) and minimum in Arka Amulya (4.83 m). Canopy spread of the tree in E-W and N-S directions ranged from 4.77-7.53 and 4.44-7.15 m. Fruit weight ranged from 157.20 to 279.84 g among different cultivars/ selections evaluated. Maximum weight was found in cv. Pant Prabhat (279.84 g), whereas minimum fruit weight (157.20 g) was observed in Hisar Surkha. Length of seed core varied from 3.69-5.54 cm. Hisar Safeda and Pant Prabhat gave the highest pulp content (97.39%) and maximum seeds pulp ratio was recorded in Hisar Safeda. The seed hardness was observed to be maximum in Lalit (16.53 kg/cm^2), while Hisar Surkha (8.42 kg/cm^2) had minimum seed hardness. Highest yield per tree was obtained in Shweta (90.62 kg/ tree), whereas lowest yield was recorded in Hybrid-21 (30.64 kg/tree). Besides, there were significant variation with regards to TSS and vitamin C. TSS content varied from 11.38 to 14.84°Brix being maximum in Hisar Surkha. Ascorbic acid content varied from 179.45 to 247.09 mg/100 g. Apart from this, significant variations were also found with respect to sugars, acidity, lycopene and anthocyanin contents in different cultivars. Overall, Hisar Surkha recorded maximum quality attributes and Lalit, Shweta and Pant Prabhat were assessed as a high yielder with moderate fruit quality.

Key words: Guava cultivars, fruit quality, fruit yield.

INTRODUCTION

Guava (*Psidium guajava* L.) belongs to family Myrataceae is one of the important fruit crops of India. It is grown widely throughout the tropics of the world. In India, it claims to be fourth most important fruit in area and production after mango, banana and citrus. Due to its better adaptability, guava is eulogized as 'The apple of tropics' (Patel *et al*., 5). It is considered to be one of the most exquisite, nutritionally valuable and remunerative crops. The fruit has strong pleasant and captivating flavour which makes it suitable for fresh consumption as well as processing. The fruit pulp is generally used for making good quality jelly. Juice is used for the preparation of sherbets and ice-cream. It freezes exceptionally well and the frozen product is practically indistinguishable from fresh fruit. The fruit is rich in vitamins A, B & C, and minerals such as phosphorus and iron. Its consumption is reported to significantly reduced blood serum total cholesterol, with an explicit increase in HDL or good cholesterol thereby reducing the risk of cardio-vascular diseases. Several cultivars such as L-49, Allahabad Safeda, Chittidar, Apple Colour *etc*. were in commercial cultivation but in the recent years, new promising selections/ cultivars of guava have been developed from different ICAR institutes and State Agricultural Universities having high yield and neutraceutical values. Hence, it was felt desirable to evaluate these improved cultivars for assessing their suitability under Lucknow conditions.

MATERIALS AND METHODS

Grafted plants of ten guava selections/cultivars, *viz*., Pant Prabhat, Lalit, Shweta (CISH-G-4), CISH-G-31, CISH-G-1, Arka Mridula, Hybrid-21, Arka Amulya, Hisar Surkha and Hisar Safeda were planted at experimental block of ICAR-CISH, Rehmankhera, Lucknow in randomized block design (RBD) at a spacing of 5 m × 5 m with five replications. The plants were maintained under uniform package of practices during the entire period of investigation. Mature fruits (greenish-yellow) were harvested from winter season crop during mid November, 2011 and 2012 for physico-chemical analysis; whereas, the rainy season crop in both the years were eliminated through pruning. The data on tree height, stem girth and canopy spread from north-south and east-west were recorded. Fruit yield per plant was computed

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by adding the fruits harvested during the winter fruiting season, *i.e.*, from first week of October to end of February, 2011 and 2012. Fruit shape, skin colour, and pulp colour were recorded visually. All the observations were recorded from composite samples of five fruits for all the characters. The fruit breadth was measured at the highest rounded portion of the fruit. Similarly, fruit length was measured from fruit base to calyx base. Seeds were extracted from the fruits from all the four directions from each replication. Seed hardness was measured by using 8 mm probe and expressed as kg/ cm^2. Maximum fracture force required to crack a seed was recorded on 20 seeds per fruit (Rajan *et al*., 8). TSS was measured by Erma Hand Refractometer (0-32°B). Total titratable acidity was calculated by titrating fruit juice against 0.1 N NaOH in the presence of phenolphthalein indicator, while, sugars were estimated volumetrically by method suggested by Lane and Eynon (3). Fresh samples were used for the analysis of ascorbic acid content using 2,6-dichloro-phenol indophenol dye by AOAC (1). Pooled data were statistically analyzed as per the procedure described by Panse and Sukhatme (6).

RESULTS AND DISCUSSION

The data presented in Table 1 showed that different cultivars differed significantly with respect to their growth parameters when measured in October after ten years of planting. The plant height was recorded maximum in Hybrid-21 (6.33 m) followed by Hisar Surkha (5.87 m) and CISH-G-1 (5.57 m) and it was minimum in Arka Amulya (4.83 m). The plant girth varied from 41.63 to 85.45 cm with maximum in Hybrid-21 and minimum in Arka Amulya. The E-W canopy spread was recorded maximum (7.53 m) in Hybrid-21 followed by Hisar Safeda (5.82 m) and Hisar Surkha (5.80 m), whereas, minimum (4.77 m) spread was in CISH-G-31 followed by CISH-G-1 (4.81 m) and Arka Mridula (4.90 m). Canopy spread in N-S direction ranged from 4.44 to 7.15 m. The maximum spread was observed in Hybrid-21 followed by Hisar Safeda (5.73 m) and Lalit (5.55 m) and minimum was observed in CISH-G-1 (4.44 m) followed by Arka Mridula (4.92 m) and Shweta (5.06 m). In general, Hybrid-21 produced more vigorous growth as compared to other cultivars, whereas, cv. Arka Amulya was found to have least vigorous growth under uniform cultural and environmental conditions. Variation in different growth characters among different cultivars/ selections were also reported by Patel *et al*. (5) under mid-hills of Meghalaya and Mahour *et al*. (4) under *Malwa* plateau conditions of Madhya Pradesh. Variation in plant growth characters in different cultivars is a genetic feature of individual genotypes and moreover these genotypes have been developed from different ecological zones of the country.

Fruit size is an important parameter of yield. Data pertaining to fruit size in term of fruit length and diameter showed significant variation among different cultivars (Table 2). The fruit length varied from 6.05-8.08 cm among different cultivars. Maximum fruit length was recorded in Hybrid-21 (8.08 cm) followed by Shweta (7.16 cm), CISH-G-31 (7.05 cm), Hisar Safeda (6.90 cm), while minimum fruit length was observed in Hisar Surkha (6.05 cm). The fruit width varied from 6.42-7.45 cm. Maximum fruit width was recorded in Hybrid-21 (7.45 cm) followed by Shweta

Table 1. Vegetative growth and fruit characters of different guava cultivars & selections.

Cultivar/ selection	Trunk height (m)	Trunk girth (cm)	Plant spread (m)		Fruit shape	Skin colour	Pulp colour
			E-W	N-S			
Shweta (CISH-G-4)	5.35	48.55	5.09	5.06	Round	Green with pink patches	Creamish-white
Arka Mridula	5.10	49.22	4.90	4.92	Oblong	Yellowish green	Creamish-white
Arka Amulya	4.83	41.63	5.08	5.06	Conical	Whitish green	White
Hisar Safeda	5.28	48.42	5.82	5.73	Oblong	Greenish	Creamish
CISH-G-1	5.57	49.15	4.81	4.44	Oblong	Green to pink spot	White
Lalit	5.47	50.21	5.60	5.55	Round	Yellowish green	Pink
Hisar Surkha	5.87	71.05	5.80	5.47	Round	Yellowish red	Pink
Hybrid-21	6.33	85.45	7.53	7.15	Conical	Yellowish green	Pink
Pant Prabhat	5.27	47.67	4.96	5.10	Conical	Whitish green	White
CISH-G-31	5.35	49.84	4.77	5.33	Round	Green	Creamish white
CD at 5%	0.226	1.188	0.162	0.152			

Table 2. Yield and fruit characteristics of different guava cultivars & selections.

Cultivar/ selection	Fruit wt. (g)	Fruit length (cm)	Fruit width (cm)	Seed core length (cm)	Pulp thickness (cm)	Yield (kg/ tree)	Seed wt. dry/ fruit (g)	Seed (%)	Pulp (%)	Seed/ pulp ratio	Seed hardness (kg/ cm^2)
Shweta (CISH-G-4)	278.42	7.16	7.43	4.10	2.05	90.62	7.64	2.74	97.26	1:35.49	11.72
Arka Mridula	204.30	6.89	6.91	4.54	1.54	72.24	7.15	3.50	96.50	1:27.57	10.66
Arka Amulya	236.61	6.80	6.90	3.69	1.56	75.17	7.10	3.00	97.00	1:32.33	9.75
Hisar Safeda	271.01	6.90	6.85	4.51	1.26	58.93	7.06	2.61	97.39	1:37.31	10.44
CISH-G-1	260.59	6.40	6.83	5.54	1.56	53.84	7.02	2.69	97.31	1:36.17	14.97
Lalit	224.28	6.08	6.74	4.75	1.47	97.04	6.93	3.09	96.91	1:31.36	16.53
Hisar Surkha	157.20	6.05	6.42	4.10	1.15	56.45	6.43	4.09	95.91	1:23.44	8.42
Hybrid-21	250.09	8.08	7.45	4.72	1.26	30.64	7.43	2.97	97.03	1:32.62	13.53
Pant Prabhat	279.84	6.70	7.32	4.64	1.38	65.26	7.31	2.61	97.39	1:27.31	10.05
CISH-G-31	197.96	7.05	7.07	4.54	1.32	67.31	7.24	3.65	96.35	1:26.39	15.84
CD at 5%	3.605	0.050	0.100	0.106	0.035	2.063	0.194	0.095	0.081		0.111

(7.43 cm) and Pant Prabhat (7.32 cm), while minimum fruit width (6.40 cm) was observed in Hisar Surkha. The maximum average fruit weight was recorded in Pant Prabhat (279.84 g) followed by Shweta (278.42 g), Hisar Safeda (271.01 g) and CISH-G-1 (260.59 g), whereas minimum fruit weight (157.20 g) was observed in Hisar Surkha. Generally, the size of the fruit is a variable character but to same extent influenced by crop load on the tree, soil moisture status, fertility status, source sink relation and other factors. The variations in fruit size and shape among the different cultivars have been reported by Mahour *et al*. (4). Among the different cultivars evaluated Shweta, Lalit, Hisar Surkha and CISH-G-31 having round fruit shape, Arka Amulya, Hybrid-21 and Pant Prabhat having conical fruit shape and Arka Mridula, Hisar Safeda and CISH-G-1 having oblong fruit shape. The outer skin colour on ripening varied among the different cultivars. The Arka Mridula, Lalit and Hybrid-21 showed yellowish-green colour peel; Arka Amulya and Pant Prabhat had whitish-green peel; Shweta had green with pink dots on peel; Hisar Safeda and CISH-G-31 had greenish-white peel. Whereas, CISH-G-1 had yellow peel with red blush on fruit surface and Hisar Surkha had yellowish-red peel colour.

Physical composition of fruits differed significantly among guava cultivars/ selections (Table 2). The length of seed core varied from 3.69-5.54 cm. The maximum seed core length (5.54 cm) was recorded in CISH-G-1 followed by Lalit (4.75 cm), Hybrid-21 (4.72 cm), Pant Prabhat (4.64 cm), Arka Mridula (4.43 cm) and CISH-G-31 (4.54 cm), whereas, minimum seed core length was recorded in Arka Amulya (3.69 cm) followed by Hisar Surkha (4.10 cm), Shweta (4.10 cm) and CISH-G-31 (4.54 cm). Hisar Safeda and Pant Prabhat gave the highest pulp content (97.39%) followed by CISH-G-1 (97.31%), Shweta (97.26%), Hybrid-21 (97.03%), whereas, lowest pulp percentage (95.91%) was recorded in Hisar Surkha. The seed content varied from 2.61 to 3.65% among cultivars and being maximum in CISH-G-31 and minimum in Hisar Safeda and Pant Prabhat. Shweta, Hisar Safeda, Pant Prabhat, Hybrid-21 and CISH-G-1 had lower seed content (<3.0%). Whereas, Hisar Surkha, Lalit, CISH-G-31 and Arka Mridula had higher seed content (>3.0%). The maximum seed: pulp ratio was recorded in Hisar Safeda and Pant Prabhat followed by CISH-G-1, Shweta, Hybrid-21 and Arka Amulya, whereas, least ratio was recorded in Hisar Surkha. Pulp thickness varied from 1.15 to 2.05 cm among the cultivars. Higher pulp thickness was recorded in Shweta (2.05 cm), Arka Amulya (1.56 cm) and CISH-G-1 (1.56 cm) and Arka Mridula (1.54 cm). Whereas, minimum pulp thickness (1.15 cm) was recorded in Hisar Surkha followed by Hisar Safeda (1.26 cm) and Hybrid-21, CISH-G-31 (1.32 cm) and Pant Prabhat (1.38 cm).

Seed hardness is one of the important parameter, which determines the table quality of the fruit. The seed hardness varied from 8.42 to 16.53 kg/ cm^2 among the cultivars. Maximum seed hardness was observed in Lalit (16.53 kg/ cm^2) followed by CISH-G-31 (15.84 kg/ cm^2), CISH-G-1 (14.97 kg/ cm^2), Hybrid-21 (13.53 kg/ cm^2) and Shweta (11.72 kg/ cm^2), whereas, minimum seed hardness was recorded in Hisar Surkha (8.42 kg/ cm^2) followed by Arka Amulya (9.75 kg/ cm^2), Pant Prabhat (10.05 kg/

cm^2) and Hisar Safeda (10.44 kg/ cm^2). Yield is one of the most important parameter, which determines the commercial value of the variety. The yield of different cultivars varied significantly. Highest yield per tree was obtained from Lalit (97.04 kg) followed by Shweta (90.62 kg), Arka Amulya (75.17 kg), Arka Mridula (72.24 kg), Pant Prabhat (65.26 kg), whereas, lowest yield was recorded in Hybrid-21 (30.64 kg). The variation among the different cultivars/ selections for fruit weight and yield per plant might be due to genetic factor and also due to climatic adaptability in a particular region, which prove to be important characters for selection of varieties/ germplasm for particular region. Varietal variation for physical characters have also been reported by Mahour *et al*. (4), Chatterjee *et al*. (2), Reddy *et al*. (9), Singh (10) and Patel *et al*. (5).

Total soluble solids, acidity, total sugars, reducing sugar, non-reducing sugar, ascorbic acid, lycopene and anthocyanin content differed significantly among different cultivars/ selections (Table 3). The TSS of the pulp ranged from 11.38 to 14.84°B, being maximum in Hisar Surkha (14.84°B) followed by Hisar Safeda (13.45°B), CISH-G-31 (13.08°B), Arka Amulya (12.99°B) and Pant Prabhat (12.63°B), whereas, minimum TSS content was recorded in Lalit (11.38°B). The total sugars content of fruit pulp among different cultivars varied from 7.86-9.60%. The maximum total sugars (9.60%) was recorded in Hisar Surkha followed by Pant Prabhat (8.88%), Lalit (8.74%), whereas, minimum total sugars content (7.86%) was recorded in CISH-G-31. The reducing sugar content of the pulp was ranged from 5.53-7.41% being maximum (7.41%) in Hisar Surkha followed by Pant Prabhat (7.23%), Arka Mridula (7.11%) and Lalit (6.75%). However, the minimum reducing sugar (5.53%) was recorded in Shweta (5.53%) followed by Hybrid-21 (5.72%). The titratable acidity in fruits ranged from 0.26-0.36% among the different cultivars. The maximum acidity (0.36%) was recorded in CISH-G-31 followed by Pant Prabhat (0.34%) and Arka Mridula (0.33%), while, minimum acidity was observed in CISH-G-1 (0.26%) followed by Lalit (0.27%) and Hisar Surkha (0.28%). The ascorbic acid content ranged from 179.45 to 247.09 mg/100 g pulp among different cultivars.

Maximum ascorbic acid content was recorded in Lalit (247.09 mg/100 g) followed by CISH-G-31 (244.56 mg/100 g), CISH-G-1 (242.94 mg/100 g) and Shweta (237.78 mg/100 g), while lowest ascorbic acid content (179.45 mg/100 g) was recorded in Pant Prabhat. Lycopene content was estimated in red pulp types. Maximum lycopene content (0.168 mg/100 g) was in Hisar Surkha followed by Lalit (0.132 mg/100 g) and minimum (0.091 mg/100 g) was in Hybrid-21. Among the cultivars/selections evaluated only one genotype, *i.e*., CISH-G-1 had red coloured outer peel. The red colour is to due to presence of anthocynin content and it was found 0.821 mg/100 g in peel. The higher and lower values for all the characters showed inheritance, which is quite helpful in finding the suitable type as per requirements. In general, Hisar Surkha recorded the maximum quality attributes except ascorbic acid content among the different cultivars evaluated. Lalit, Shweta and Pant Prabhat were assessed as high yielder with moderate fruit quality. These results are in agreement with the findings of Chatterjee *et al*. (2), Sharma *et al*. (11), Reddy *et al*. (9), Patel *et al*. (5), Singh *et al*. (12) and Singh *et al*. (13).

Table 3. Quality characters of different guava cultivars & selections.

Cultivar/ selection	T.S.S. (°Brix)	Acidity (%)	Ascorbic acid (mg/100 g pulp)	Reducing sugar (%)	Total sugars (%)	Lycopene (mg/100 g pulp)	Anthocyanins (mg/100 g pulp)
Shweta (CISH-G-4)	11.90	0.32	237.78	5.53	8.07	-	-
Arka Mridula	12.22	0.33	237.87	7.11	8.14	-	-
Arka Amulya	12.99	0.32	200.74	6.20	8.76	-	-
Hisar Safeda	13.45	0.26	196.56	6.11	8.46	-	-
CISH-G-1	12.18	0.28	242.94	6.16	8.10	-	-
Lalit	11.38	0.27	247.09	6.75	8.74	0.132	0.821
Hisar Surkha	14.84	0.28	216.78	7.41	9.60	0.168	-
Hybrid-21	11.73	0.29	229.93	5.72	8.32	0.091	-
Pant Prabhat	12.63	0.34	179.45	7.23	8.88	-	-
CISH-G-31	13.08	0.36	244.56	6.10	7.86	-	-
CD at 5%	0.188	0.027	2.997	0.103	0.110	0.016	-

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