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Comparative study on performance of guava genotypes during rainy and winter season under Bhubaneswar condition

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ABSTRACT

The performance of eight guava genotypes viz. Hisar Safeda, Pant Prabhat, Shweta, Hisar Surkha, L-49, Banaras Round, Allahabad Safeda and HRS Pride was carried out at Horticultural Research Station, Orissa University of Agriculture and Technology, Bhubaneswar in both rainy and winter season during 2015-16 and 2016-17. The guava plants were planted at a spacing of 5m × 5m on 16th July, 2011. Plant height, canopy spread and canopy volume was recorded significantly highest in Pant Prabhat over other cultivars while Hisar Safeda recorded maximum trunk diameter (cm) during both rainy and winter season. The final fruit retention percentage was found maximum in Pant Prabhat (67.00 %) during rainy season and in Shweta (60.67 %) during winter season. The fruit weight, fruit volume, fruit length during both seasons was recorded maximum in Pant Prabhat. The yield per plant varied significantly and recorded maximum in Pant Prabhat (14.67 kg) during rainy season and in Shweta (13.98 kg) during winter. From the result of the experiment Pant Prabhat, Shweta and Hisar Surkha were found superior over other genotypes in respect of growth, yield, fruit retention and other fruiting characters during both the season. In respect of qualitative parameters Shweta, Pant Prabhat, HRS Pride was found better compared to other varieties studied.

Key words: *Psidium guajava*, flowering, maturity, yield, quality.

INTRODUCTION

Guava (*Psidium guajava* L.) belongs to the family Myrtaceae, is an important fruit crop of tropical and sub tropical regions. It is the fifth most important fruit crop in production after banana, mango, citrus and papaya with a total production of 1.68 million tonnes. Due to its better adaptability in diverse agro-climatic conditions, high nutritive value, early and prolific bearing with a good return, guava is eulogized as 'The apple of tropics' (Patel *et al*.,12).The fruit is rich in vitamins C, A and B_1 and minerals like phosphorus and iron. It contains about 180-300 mg of vitamin C per 100 g of pulp. The fruit has high demand for both table purpose as well as in processing industry for preparation of jam and jelly. It contains antioxidant factors and can control systolic blood pressure (Brar *et al*., 2). The need for improvement of this fruit crop is therefore, imperative and requires active consideration, hence critical evaluation of genotypes with regard to growth, flowering and fruiting is necessary. Selection of varieties suited to a specific climatic condition on the basis of growth, fruit set, fruit maturity and yield is very important to make guava cultivation economically viable. Further the same variety which performs better in one locality may not behave identically in another locality. The yield and quality of local types grown by the farmers in the coastal agroclimatic region under study is poor and not able to with stand competition from other improved cultivars. Therefore, the present investigation was conducted to find out the suitability of newly evolved varieties of guava for growing under Bhubaneswar condition.

MATERIALS AND METHODS

The field experiment was carried out during 2015-16 and 2016-2017 at the Horticultural Research Station, Odisha University of Agriculture and Technology, Bhubaneswar. It lies in between 20°15'N latitude and 85°52'E longitude and with an altitude of 25.5 m above mean sea level. It is located on the coastal plains of Odisha which experiences typical tropical weather conditions and succumbs to the heat and cold waves that sweep in from north India. The summer months from March to May are hot and humid and temperatures often go beyond 40°C in May. July and August receive the maximum rainfall (with average over 220 mm a month).Favourable weather conditions prevail during November in Bhubaneswar, but December and January experience the cool winds from the North & North-East. Temperatures drop to approximately 15°C during these months. The soil of experimental site was taxonomically classified as Aeric Tropaquept having order Inceptisol. It has sandy

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loam texture. The place is characterized by warm and moist climate with hot and humid summer and mild winter. The experiment was conducted in Randomized block design (RBD) with eight treatments (cultivars) and three replications. The air layered guava plants were five years old and planted in Horticulture Research Station, Baramunda, OUAT, Bhubaneswar on 16-7-2011 at a spacing of 5 × 5 meter. In each replication normal recommended cultural practices were followed during the course of investigation. There were eight varieties consisting of elite guava selections and hybrids *viz.*, Hisar Safeda, Pant Prabhat, Shweta, Hisar Surkha, L-49, Banaras Round, Allahabad Safeda and HRS Pride. The brief character of the guava cultivars are mentioned below:

Hisar Safeda: It has upright growth with roundish fruits weighing about 92g each. Pulp is creamy white with few soft seeds having TSS content of 13.4% and ascorbic acid content of 185 mg/100g. Plant prabhat: It is a seedling selection from GBPUAT, Pantnagar, prolific bearer, soft seeded with good quality fruits. Shweta: It is a selection from the population of Apple colour guava and was released by CISH, Lucknow for commercial cultivation. The fruits are medium sized with white exocarp having red blush, with snow white pulp, high TSS (12.5-13.2 per cent content) with good keeping quality. Hisar Surkha: Tree is medium in height with roundish fruits weighing 86g each. Pulp is pink having 13.6% TSS with a yield of 94 kg/tree/ year. L-49: It is a selection from Allahabad Safeda at Pune by Cheema and Deshmukh. The trees are Semi dwarf, high yielding and fruits are white fleshed. The fruits have few soft seeds and their quality is excellent. Allahabad Safeda: The plants have upright growth habit with medium sized fruits. The fruits are round, smooth which are yellowish white in colour with white colour flesh. Banaras Round: The plants have broad crown and fruits are round, light-yellow in colour. It is mainly cultivated for table purpose.

The observations on growth, fruit set, fruit drop, fruit retention, fruit maturity and yield were recorded in two seasons i.e. for ambe bahar (rainy season) and mrig bahar (winter season) crop of guava. The average data on observations of vegetative growth characters like plant height (m), trunk dimeter (cm), canopy spread (East-West and North-South in m) were recorded from three randomly selected trees in each treatment during both the season. The Canopy volume (m^3) was calculated by the following formula as described by Westwood (15). The time required from fruit set to harvesting was recorded by counting the number of days from fruit setting to (firm ripe stage). Tagging of 200 numbers of just opened flowers was done for taking this observation. The data on fruit drop was taken by tagging 200 numbers of just setted fruits and the data were recorded at mature stage during both the season. The numbers of fruits were taken during both the rainy and winter season by counting at maturity stage just before harvesting at an interval of 15 days during the fruiting period from February 2015 to January 2016 and from February 2016 to January 2017. The fruits of each plant were weighed separately by top pan balance and recorded at each picking. The volume of fruit was measured by the conventional water displacement method and expressed in ml. Specific gravity was calculated by dividing weight of fruit (g) with volume of fruit (ml). The average fruit yield per plant was calculated by multiplying the total number of fruits per tree with the average fruit weight and was expressed in kilogram per tree. Physico-chemical analysis of fruits was taken on ten randomly selected mature fruits from each plant during both seasons. The TSS was determined by using a hand refractometer and was expressed in °Brix. Titratable acidity was determined and expressed as per cent citric acid as described by Ranganna (13).To estimate the acidity %, a known quantity of sample (5g of pulp) was taken and ground to paste using distilled water. Samples were diluted with distilled water and volume was made upto 50 ml from which a small amount (10 ml) was taken in a small conical flask and titrated against 0.01N NaOH using phenolphthalein indicator. Titration was carried out and the end was determined by the appearance of pink colour and its persistence for at least two seconds. Titrable acidity was determined and expressed as per cent citric acid as described by Ranganna (13).It was calculated by using formula Acidity (%) = Titrate value × 0.064. The ascorbic acid content was determined by the standard method as per AOAC (1). For estimating ascorbic acid content 50 mg of 2, 6 di-chlorophenol indophenol dye and 42 mg sodium bicarbonate was dissolved in 10 ml distilled water. Final volume was made to 200 ml with distilled water. Dye was filtered and stored in dark colored bottle at low temperature. Two ml of fruit juice was mixed with 2 ml of 3 % metaphosphoric acid as buffer. It was titrated with 2, 6-dichlorophenol indophenol dye till the light pink colour appeared. The results were expressed as mg of ascorbic acid per 100 ml of juice. The total and reducing sugars were estimated by following Shaffer Shomogi method as described by Ranganna (13) and expressed as per cent. To estimate the total sugars, 10 ml of juice was taken in 250 ml volumetric flask and 5 ml of 1N HCL was added to it followed by addition of 30 ml of distilled water. Then it was titrated with 1N NaOH solution taken in a burette. Percentage of total sugar was calculated by the formula 50 / titrate value. For estimating the reducing sugar, 10 ml of filtrate juice

of guava was taken in 100 ml volumetric flask and volume was made by adding distilled water. The entire content is then transferred to a 100 ml burette. In a 250 ml capacity conical flask 5 ml each of Fehling solution A and B were taken followed by addition of 40 ml distilled water and was mixed thoroughly. The 2-3 drops of Methylene blue indicator was added and it was titrated against sample in the burette till the end point consists of brick red colour. The reducing sugars were estimated by following Shaffer Shomogi method as described by Ranganna (13) and expressed as per cent by using the formula (0.05 × volume)/ (Titratin value X10) multiplied by 100. Data collected were pooled and the analysis and interpretation of data were done using the method of Panse and Sukhatme (11) in randomized block design.

RESULTS AND DISCUSSION

The data presented in the Table 1 showed that different cultivars differed significantly with respect to their growth parameters measured in both rainy and winter season after five years of planting. The maximum plant height was obtained in Pant Prabhat (3.77 m during rainy season and 3.87 m during winter season) and minimum in Hisar Surkha during both the season (3.40 m in rainy season and 2.73 m in winter). So Pant Prabhat showed maximum plant height during both the season. It was found significantly different from L-49, Banaras Round, Shweta and Hisar Safeda during rainy season while during winter season it was significantly different from Shweta and Hisar Surkha. The maximum height of tree might be due to the capacity of the plant root zone to absorb more nutrient matter that causes vigorous growth. This difference might be also due to individual growth behaviour of different genotypes (Dubey *et al*.,5). The trunk diameter was found to be statistically significant among all the genotypes of guava studied. The trunk diameter was recorded minimum in Banaras Round (33.41 cm during rainy season and 34.47 cm during winter season) and maximum in Hisar Safeda (47.92 cm during rainy season and 48.14 cm during winter season). Hisar Safeda recorded maximum trunk diameter and was found statistically at par with the variety Pant Prabhat and significantly different than other varieties with respect to trunk diameter. The minimum trunk diameter was obtained in Banaras Round during both the season. The canopy spread in East-West and North-South direction showed statistically significant different responses in all the cultivars studied during the present investigation. The canopy spread in both East-West and North-South direction was recorded maximum in Pant Prabhat (4.13 m during rainy season and 4.83 m during winter season) and minimum in L-49 (2.70 m during rainy and 3.30 m winter season).

From the data presented in the Table 1, indicates significant differences among guava cultivars with respect to the canopy volume of the plant which was noticed maximum in Pant Prabhat (154.13 m^3 during rainy season and 165.46 m^3 during winter season) and minimum in L-49 (58.53 m^3 during rainy and 63.42 m^3 during winter season). Pant Prabhat was found to be superior over the check variety Allahabad Safeda and significantly different from rest of the genotypes during both the rainy and winter season. This might be due to the genotypic differences prevailing among respective genotypes and influenced to generate the variation in above growth characters and also might be due to growing of cultivars in different agro climatic conditions. The present findings are also in

Table 1. Performance of different cultivars of guava for Vegetative characters during rainy and winter season.

Varieties	Plant height (m)		Plant girth (cm)		Canopy spread (East-West) in (m)		Canopy spread (North-South) in (m)		Canopy volume (m^3)	
	RS	WS	RS	WS	RS	WS	RS	WS	RS	WS
Hisar Safeda	3.40	3.57	47.92	48.14	3.23	3.40	3.83	3.97	93.33	104.24
Pant Prabhat	3.77	3.87	41.95	43.46	4.13	4.23	4.83	4.93	154.13	165.46
Shweta	2.93	3.07	40.24	41.30	3.50	3.70	3.77	4.17	80.91	98.99
Hisar Surkha	2.50	2.73	40.24	41.58	3.74	3.80	4.13	4.13	80.68	86.54
L-49	2.93	3.37	36.83	37.96	2.70	2.83	3.30	3.37	58.53	63.42
Banaras Round	3.57	3.23	33.41	34.47	3.33	3.43	3.70	3.83	93.31	99.81
Allahabad Safeda	3.63	3.70	36.83	37.95	3.73	3.87	3.50	3.70	101.01	111.80
HRS Pride	3.67	3.73	41.09	41.83	3.37	3.37	3.33	3.47	88.72	98.38
S.E (m) ±	0.23	0.13	2.13	1.61	0.23	0.20	0.29	0.27	15.97	15.64
CD at (5%)	0.67	0.37	6.22	4.70	0.66	0.59	0.86	0.79	46.73	45.75

agreement with the finding of Sarkar *et al*. (14) and Dolkar *et al.* (4) who reported that the variations in plant growth characters in different varieties could be a generic feature of individual genotype or a varietal character as well as environmental influence.

From the data depicted in the Table 2, it was obvious that Hisar Surkha and L-49 took shortest period (124 days during rainy season and 123 days during winter season respectively) from flowering to fruit maturity, while longest period from flowering to fruit maturity was noticed in Pant Prabhat (134 days during rainy season and 138 days during winter season). This result is in close proximity with the findings of Deshpande (3) who reported that the number of days from flowering to fruit maturity varied between 121.33 (cv. GR-1) and 125.93 (cv. CIW- 5) in an evaluation study conducted by under Arabhavi conditions. However, Milan (10) observed that the period from flowering to fruit maturity varied between 105 days to 124 day in different cultivars of guava. Highest fruit set (%) at 15 days after anthesis was recorded in Pant Prabhat (82.67 % during rainy and 73.67 % during winter) and lowest fruit set (%) was found in Hisar Surkha (68.00 % during rainy and 64.00 % during winter). This result was in contrary to the findings of Dubey *et al.* (6) who observed higher fruit set during winter season as compared with other cropping season. The highest and lowest fruit drop was recorded in Banaras Round (52.67 %) and Pant Prabhat (33.00 %) respectively during rainy season while during winter season it was found highest in Hisar Safeda (60.33 %) and lowest in Shweta (39.33 %). The final fruit retention percentage was found minimum in Banaras Round (47.33 %) to a maximum of 67.00 % in Pant Prabhat during rainy season, whereas Shweta (60.67 %) and Hisar Safeda (39.67 %) were recorded to retain highest and lowest fruit at maturity during winter season, respectively.

The guava cultivars differed significantly with respect to number of fruits per plant. During rainy season, it was found maximum in Pant Prabhat (99.00) and minimum in Allahabad Safeda (52.00). During winter season, it was recorded maximum in Shweta (96.00) and minimum in Hissar Surkha (39.67) (Table 3). The yield per plant varied significantly and recorded maximum in Pant Prabhat (14.67 kg) during rainy season and Shweta (13.98 kg) during winter season where as the minimum yield was found in Allahabad Safeda (5.62 kg) and Hisar Surkha (3.91 kg) during rainy and winter season respectively (Table 3). This result was in consonance with the findings of Ghosh *et al*. (7) who obtained more yield during rainy season than winter season fruits. The variation among varieties with regards to yield per plant might be due to their genetic potential to produce fruits of higher weight and their interaction with environment. In some of the cultivars though the number of fruits per plant was more but fruit yield was not so accordingly, which may be due to distribution and diversion of available assimilates in more number of fruits.

The fruit weight during both rainy and winter season was recorded maximum in Pant Prabhat (147.63 g and 150.60 g respectively) while minimum fruit weight was obtained in Banaras round (106.73 g) during rainy season and Hisar Safeda (112.37 g) during winter season (Table 4). The fruit that matured during winter season attained more weight than during rainy season. The yield in rainy season is more as compared to winter season which may be due to production of more number of fruits per plant during rainy season as compared to winter

Table 2. Fruit set, fruit drop, fruit retention and fruit maturity in different guava cultivars during rainy and winter seasons.

Variety	Fruit set (%) at 15 days after anthesis		Fruit drop (%)		Final fruit retention (%)		Period required from fruit set to maturity (Days)	
	RS	WS	RS	WS	RS	WS	RS	RS
Hisar Safeda	76.00	68.33	40.67	60.33	59.43	39.67	126.00	130.00
Pant Prabhat	82.67	73.67	33.00	46.67	67.00	53.33	134.00	138.00
Shweta	80.00	66.67	36.00	39.33	64.00	60.67	132.00	135.00
Hisar Surkha	68.00	64.00	37.33	55.00	62.67	45.00	124.00	127.00
L-49	77.00	73.00	44.33	48.67	55.67	51.33	127.00	123.00
Banaras Round	74.67	69.33	52.67	60.00	47.33	40.00	125.00	129.00
Allahabad Safeda	79.00	68.33	48.33	49.92	51.67	50.08	127.00	131.00
HRS Pride	80.00	72.67	43.67	51.67	56.33	48.33	129.00	131.00
S.E (m) ±	1.68	2.75	2.94	3.64	2.79	3.48	1.07	0.54
CD at (5%)	4.92	NS	8.60	10.65	8.15	10.20	3.14	1.58

Table 3. Yield parameters of different cultivars of guava during rainy and winter seasons.

Varieties	Number of fruits per plant		Yield per plant (kg)		Yield per ha (q)	
	RS	WS	RS	WS	RS	WS
Hisar Safeda	86.33	44.67	9.75	4.41	39.00	17.66
Pant Prabhat	99.00	49.33	14.67	7.42	58.68	29.69
Shweta	67.33	96.00	8.17	13.98	32.66	55.90
Hisar Surkha	61.00	39.67	7.51	3.91	30.05	15.63
L-49	57.00	42.67	6.65	5.03	26.61	20.13
Banaras Round	58.00	40.67	6.19	4.76	24.77	19.05
Allahabad Safeda	52.00	44.67	5.62	4.88	22.47	19.52
HRS Pride	55.67	40.00	6.76	4.66	27.05	18.64
S.E (m) ±	2.82	3.15	0.59	0.51	2.34	2.05
CD at (5 %)	8.26	9.21	1.71	1.50	6.85	5.99

Table 4. Physical characters of fruits of different guava cultivars during Rainy and winter seasons.

Varieties	Fruit length (cm)		Fruit breadth (cm)		Ratio of fruit length/breadth		Fruit weight (g)		Fruit volume (ml)		Specific gravity	
	RS	WS	RS	WS	RS	WS	RS	WS	RS	WS	RS	WS
Hisar Safeda	6.39	6.24	6.59	6.53	0.97	0.96	112.97	112.37	118.31	116.96	0.96	0.96
Pant Prabhat	6.60	6.32	6.62	6.49	0.99	0.98	147.63	150.60	153.55	154.18	0.96	0.98
Shweta	5.73	6.23	5.44	6.61	1.05	0.95	129.17	145.77	133.00	150.36	0.97	0.97
Hisar Surkha	6.32	6.13	6.66	6.72	0.95	0.91	123.00	119.80	131.73	125.26	0.93	0.96
L-49	6.17	5.80	6.43	6.17	0.96	0.94	116.63	134.60	123.18	140.67	0.95	0.96
Banaras Round	5.38	5.29	5.11	5.72	1.05	0.92	106.73	112.63	112.39	118.44	0.95	0.95
Allahabad Safeda	5.92	6.04	5.24	5.50	1.14	1.10	107.93	124.93	112.70	129.68	0.96	0.96
HRS Pride	5.61	5.61	6.31	6.39	0.89	0.88	120.50	126.83	126.85	132.25	0.95	0.96
S.E (m) ±	0.20	0.21	0.25	0.23	0.03	0.03	4.57	2.68	4.71	2.79	0.01	0.01
CD at (5%)	0.58	0.63	0.72	0.68	0.09	0.09	13.37	7.84	13.79	8.16	NS	NS

season. The fruit length varied significantly among genotypes during study. Fruit size is an important parameter of yield. Data pertaining to fruit size in term of fruit length and width showed significant variation among different cultivars (Table 4). The longest fruit was recorded in Pant Prabhat (6.60 cm in rainy season and 6.32 cm in winter season), while shortest fruit was obtained in Banaras Round (5.38 cm during rainy and 5.29 cm during winter season). Significant variations during changes in fruit diameter of guava were also recorded among the genotypes. Fruit width was observed maximum in Hisar Surkha (6.66 cm during rainy and 6.72 cm during winter season) respectively (Table 4). Significant variation was found in guava genotypes with respect to the volume of the fruit which was recorded maximum in Pant Prabhat (153.55 ml and 154.18 ml during both rainy and winter season respectively) and minimum in Banaras Round (112.39 ml) and Hisar Safeda (116.96 ml) during rainy and winter season respectively. There were no significant differences among the varieties with respect to the specific gravity of the fruits which was found maximum in Shweta (0.97) and minimum in Hisar Safeda (0.93) during rainy season. During winter season, Pant Prabhat (0.98) and Banaras Round (0.95) recorded maximum and minimum specific gravity respectively.

The chemical parameters like TSS, acidity, total sugars, reducing sugars, non-reducing sugars and ascorbic acid content differed significantly among different genotypes (Table 5). Significant variation in TSS with the maximum (12.27°Brix and 12.38°Brix) was observed in Pant Prabhat during rainy and winter season respectively where as the minimum TSS (9.88°Brix and 10.52°Brix) was observed in L-49 respectively during rainy season and winter season

Table 5. Quality characters of different guava cultivars during rainy and winter seasons.

Varieties	TSS (°Brix)		Acidity (%)		TSS : acid ratio		Ascorbic acid (mg/ 100 g edible portion)		Total sugar (%)		Reducing Sugar (%)		Non-reducing Sugar (%)	
	RS	WS	RS	WS	RS	WS	RS	WS	RS	WS	RS	WS	RS	WS
Hisar Safeda	10.77	11.35	0.30	0.42	36.47	27.35	103.00	119.83	8.23	8.42	4.41	4.43	3.63	3.79
Pant Prabhat	12.27	12.38	0.27	0.27	45.06	46.54	125.00	158.40	9.33	9.29	5.54	5.46	3.60	3.64
Shweta	12.05	12.23	0.33	0.32	35.99	38.19	147.17	207.83	9.03	9.35	5.35	5.55	3.50	3.61
Hisar Surkha	10.98	11.37	0.42	0.33	26.88	34.92	117.83	146.50	8.20	8.27	4.11	4.14	3.88	3.92
L-49	9.88	10.52	0.48	0.43	20.60	24.61	154.67	226.00	8.78	8.90	4.72	4.73	3.86	3.96
Banaras Round	10.78	10.88	0.32	0.37	33.72	29.56	93.00	110.33	6.36	7.10	3.55	3.70	2.68	3.23
Allahabad Safeda	10.23	10.72	0.36	0.56	28.07	19.18	116.33	138.83	8.10	8.17	4.11	4.20	3.79	3.77
HRS Pride	10.43	10.62	0.29	0.28	36.54	37.55	96.67	114.67	7.12	7.17	3.69	3.74	3.26	3.26
S.E (m) ±	0.18	0.15	0.01	0.01	1.29	1.32	10.74	13.12	0.03	0.03	0.16	0.14	0.14	0.12
CD at (5%)	0.53	0.43	0.04	0.04	3.77	3.86	31.42	38.39	0.09	0.10	0.48	0.40	0.42	0.35

(Table 5). During rainy season maximum acidity (0.48 %) was found in L-49 where as it was minimum (0.27 %) in Pant Prabhat. Highest and lowest acidity was recorded in Allahabad Safeda (0.56 %) and Pant Prabhat (0.27 %) respectively during winter season. Pant Prabhat had highest TSS: acid ratio (45.06 during rainy season and 46.54 during winter season) (Table 5).The TSS: acid ratio is a key characteristic determining the quality, taste, texture and feel of guava fruits which contributes towards giving many fruits their characteristic flavour and also indicator of commercial and sensory ripeness. The maximum ascorbic acid content was recorded in L-49 (154.67 mg/100 g pulp) and minimum in Banaras Round (93.00 mg/100 g pulp) during rainy season crop of guava. During winter season, the maximum ascorbic acid content was recorded in L-49 (226.00 mg/100 g pulp) while it was noticed minimum in Banaras Round (110.33 mg/100g pulp). The total sugar content was found maximum in Pant Prabhat (9.33 %) and minimum in Banaras Round (6.36 %) during rainy season where as in winter it was found maximum in Shweta (9.35 %) and minimum in Banaras Round (7.10 %). Reducing sugar was also found highest in Pant Prabhat (5.54%) during rainy season and Shweta during winter season (5.55 %) while it was recorded lowest in Banaras Round in both the season (3.55 % during rainy and 3.70 % during winter). An increase in TSS was recorded during winter season over that of rainy season. This may be due to low water content and high soluble solids in the fruits during winter season. This result was in line with the findings of Kumar *et al.* (9) who obtained highest TSS (10°Brix) in Chittidar followed by (9.8°Brix) in Apple Colour. They also reported that acidity ranged between 0.38 % (L-49) to 1.53 % (Apple Colour) and maximum sugar was found in cv. L-49 (7.06 %) followed by Chittidar (6.97 %).Ascorbic acid content was found maximum in the winter season. Rainy season fruit contains less vitamin C, TSS and sugar. This might be due to cloudy weather and presence of relatively more moisture in soil which must have moved in to the fruit and diluted the organic metabolites particularly sugars. Furthermore, it seems that temperature play an important role which governs the enzymatic systems involved in biogenesis and catabolism of ascorbic acid. The present findings are also in agreement with the finding of Haji *et al.* (8) and Ghosh *et al.* (7) who found superior fruits in winter season to that of rainy season in respect of different biochemical parameters.

Though higher yield was obtained in rainy season crop but the quality of the fruit was found superior during winter season on account of higher TSS:

acid ratio in most of the cultivars studied. The cultivars Prabhat, Shweta and Hisar Surkha were found superior in respect of growth, fruit set, fruit retention, yield and other fruiting characteristics during both rainy and winter season and hence can be recommended for cultivation under Bhubaneswar condition of Odisha.

REFERENCES

1. A.O.A.C. 1990. *Official Method of Analysis.* Association of Official Analytical Chemist, Washington DC. USA.
2. Brar, J.S., Dhaliwal, H.S. and Gill, M.S. 2015. Split application of inorganic fertilizers for rainy and winter season crops in guava cv. L-49. *Indian J. Hort*. **72**: 466-71.
3. Deshpande, R.S. 2006. Varietal evaluation and influence of vermicompost in guava, M.Sc. (Agri.) thesis, University of Agricultural Science, Dharwad.
4. Dolkar, D., Bakshi, P., Wali, V.K., Bhusasn, B. and Sharma, A. 2014. Growth and yield attributes of commercial guava cultivars under sub-tropical condition. *Indian J. Plant Phy.* **19**: 79-82.
5. Dubey, P.S., Hoda, M.N. and Singh, S. 2002. Studies on growth behaviour of guava germplasm under Sabour conditions for rainy season fruiting. *Indian J. Hort.* **57**: 326-28.
6. Dubey, P.S., Hoda, M.N., Singh, J. and Singh, S.K. 2004. Flowering and fruiting characters of guava varieties during rainy season fruiting. *Orissa J. Hort.* **32**: 23-25.
7. Ghosh, S.N., Roy, S. and Bera, B. 2013. Study on performance of twenty one guava cultivars in red and laterite soil of West Bengal under irrigated condition. *J. Crop Weed*. **9**: 81-83.
8. Haji, S.A., Heyat, S. and Banday, S.A. 2012. Effect of season on physiological changes in Guava (*Psidium guajava* L.) cv. Allahabad Safeda grown under Allahabad conditions, *Indian Hort.* **2**: 68-70.
9. Kumar, S., Kumar, S. and Shukla, R. 2006. Physico-chemical characteristics of some guava (*Psidium guajava* L.) cultivars. *The Hort. J.* **19**: 5-7.
10. Milan, A.R. 2007. Breeding of *Psidium* species for root knot nematode resistance in Malaysia. *Acta Hort.* **735**: 61-69.
11. Panse, V.G. and Sukhatme, P.V. 1989. *Statistical methods for Agricultural workers.* Indian Council of Agricultural Research, New Delhi, pp. 199-210.
12. Patel, R.K., Matli, E.S., Dev, B.C., Desmukh, N.A. and Roy, D. 2011. Variability studies in guava (*Psidium guajava* L.) genotypes for growth yield and quality attributes at mid-hills of Meghalaya. *Indian J. Hill Farmg*. **24**: 24-28.
13. Ranganna S. 1977. *Manual of analysis of the fruits and vegetable products.* Tata McGraw Hill publication Company Ltd., New Delhi, India.
14. Sarkar, T., Sarkar, S.K., Sarkar, T. and Sau, S. 2016. Growth and yield attributes of guava (*Psidium guajava* L.) varieties under West Bengal condition, *Int. J. Agric Sci*. **8** : 3499-501.
15. Westwood, M.N. 1993. Plant efficiency: Growth and yield measurements. *Temperate zone pomology,* W. H. Freeman and company (San Francisco). pp. 275-82.

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