

Morphological and Physiological Characterization of Different Guava Cultivar's under Semi-arid Zone of Haryana

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ABSTRACT

Guava varieties for different morpho-physiological traits were evaluated at Guava Demonstration Center, Bhuna (Fatehabad) and in Postgraduate Laboratory of the Department of Horticulture, CCS Haryana Agricultural University, Hisar during the year 2018-19 for both the season i.e., rainy and winter. Quantitative and qualitative characters of fifteen guava varieties with distinct variation was observed. Among these characters flowering and fruit were critical observed and a wide variation in flowering parameters has been recorded. The time of flower initiation period varied from 20th April to 1st May. The duration of flowering of different guava varieties during rainy season showed variations from 27 to 35 days. Pant Parbhat, Banarsi Surkha showed ovate shape of fruit,

while, Barf Khana had globose type of fruit shape. KG Guava had maximum fruit length of 10.05 cm and diameter (width) of 8.16 cm during rainy season. Highest fruit weight of 362.0 g and 412.3 g was noticed in KG Guava during both the season i.e., rainy and winter.

Keywords Duration, Flowering, Guava varieties, Parameters, Season.

INTRODUCTION

In India, Guava is important cultivated fruit crops. It has prolific habit of growth and production in tropical and sub-tropical regions for this it also considered as “Apple of Tropics”. Guava is originated from tropical America but grown in all the tropical and subtropical countries of the world. At world level India is the largest producer of guava similarly, it has fifth place in terms of area (2.65 lakh ha) and production (40.54 lakh metric tons) respectively, in India (Anonymous, 2018a). It can be grown upto an altitude of 1500 m above mean sea level. Guava can tolerate environmental stress but young plants are susceptible to drought and cold condition. The abundant and better quality fruits are produced in areas having a distinct winter than tropical areas. Thus, the area under this crop is spreading very fast. It varies with the cultivar's, management practices and season of cropping.

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Asexually propagated guava plants start flower-

ing and fruiting from 2 to 3 years after planting but economic yield is obtained from 5 to 6 years onwards. Vegetative means of propagation in Guava includes cuttings, air layering, grafting and budding. Budding is easier in operation and cheaper than inarching and air layering has been reported to be quite successful at Basti. In some parts of country, guava is still commonly grown from the seeds. Self-pollination is conspicuous (60–75 %) and isolated trees produce good crop but the distribution of cross-pollination by insects is about 35%. Guava flower buds are borne in leaf axil on current season's growth, either singly or in cymose of two or three. The flowers consist of a superior calyx with five lobes and the corolla consists of 6 to 10 petals arranged in one or two whorls. The androecium consists of 160 to 400 thin filaments carrying bi-lobed anthers, closely packed together (Dinesh and Vasugi 2010). It has been cultivated in India since early 17th century and gradually became a crop of commercial significance. The natural fruit set is quite high and about 80 to 86% of flowers set fruits but due to severe fruit drop only 34 to 56% of fruit attained maturity.

MATERIALS AND METHODS

The field experiment was conducted at Guava Demonstration Center, Bhuna (Fatehabad) Haryana, which is situated at an altitude of 222 m above mean sea level with coordinates of 29°32'11" North and 75°42'39" East of Haryana with selection of forty five uniformly grown plants, randomly all the agronomic practices were carried out as per recommended package of practices. All varieties were maintained under uniform condition of orchard management during the study period. The ages of varieties (Aishwariya, Allahabad Safeda, Arka Kiran, Arka Mridula, Banarsi Surkha, Barf Khana, Hisar Safeda, Hisar Surkha, Lalit, L-49, KG Guava, Pant Parbhat, Punjab Pink, Pant Red, Shweta) was 7 years old with spacing of 6×3 meters. The flowering parameter such as time of initiation of flowering (date) was measured in each direction of tree, four branches were selected randomly and tagged. These branches were observed regularly to see the initiation of flowering and date of five per cent flower bud open was noted down. The date of five per cent flower bud opening varied in different replications was mentioned in the date

whereas, flowering duration (days) was calculated from the date of initiation of flowering to date of the end of flowering and the average time taken in duration of flowering was expressed in days. The time taken for fruit ripening (days) was observed from the date of fruit setting to the date of fruit ripening and noted down to calculate time taken from fruit setting to fruit ripening in days. Fruit shape was visualized by selecting five fruit randomly from each replication. The shape of fruits was visualized according to the guidelines for DUS testing of PPV and FRA (Anonymous 2016). Similar, procedure was followed in observation of fruit surface. For fruit length (cm) and diameter (width) (cm), five fruits were selected randomly from each replication and length and diameter (width) (cm) of these fruits was measured with the help of vernier calliper. Average value of fruit length and diameter (width) (cm) was calculated and expressed in centimeters. Fruit weight (g) was observed by selecting five fruits randomly from each replication and fruits were weighed on top pan electric balance. Average value of fruit weight was calculated by dividing total fruit weight with total number of fruits taken and expressed in grams. Five fruits were selected randomly from each replication and color of fruit skin was visualized, similar, procedure was followed in pulp color observation.

Statistical analysis

Analysis of variance (ANOVA) for Randomized Block Design was done and significant (≤ 0.05) differences between treatments were determined using least significant difference (LSD 0.05). The software program used for the analysis was statistical software package for Agricultural Research Workers (Sheoran *et al.* 1998).

RESULTS AND DISCUSSION

A total of fifteen varieties was evaluated for flowering and fruit characteristics of different guava varieties includes time of initiation of flowering (date), flowering duration (days), time taken for fruit ripening (days), fruit shape, surface, length (cm), diameter (width) (cm), weight (g), fruit skin color and pulp color. Among the studied varieties two different season of flowering initiation have been observed i.e., rainy

Table 1. Flower initiation, flower ending and flower duration of different guava varieties under semi-arid condition of Haryana during rainy season.

Varieties	Date of flower initiation	Date of flower ending	Flower duration (days)
Aishwariya	22 April	20 May	28
Allahabad safeda	20 April	17 May	27
Arka kiran	23 April	21 May	28
Arka mridula	21 April	20 May	29
Banarsi surkha	22 April	22 May	30
Barf khana	22 April	20 May	28
Hisar safeda	23 April	22 May	29
Hisar surkha	26 April	24 May	28
KG guava	30 April	31 May	31
Lalit	27 April	27 May	30
L-49	26 April	25 May	29
Pant parbhat	01 May	05 June	35
Pant red	22 April	20 May	28
Punjab pink	24 April	23 May	29
Shweta	30 April	02 June	33

(April-May) (Table 1) and winter (August) (Table 2), similarly, ending of flowering observed from May to June in rainy season (Table 1) and September to February (Scattering flowering) (Table 2). Such type of variations was also observed by Singh *et al.* (2016) and Sharma *et al.* (2017) who reported two season of flowering in Hisar conditions. However, these results are contradict to season observed in Uttar Pradesh viz., February to June (Sharma *et al.* 2017).

Duration of flowering period in different varieties varied from 27-35 days during rainy flowering season (Table 1) and from 47 days to could not be specified in winter flowering season (Table 2). The climate during winter was mild as compared to that of rainy flowering season which perhaps prolonged the duration of flowering during winter season. Duration of flowering in guava is also reported by Sharma *et al.* (2017) and Singh *et al.* (2016). It appears that like time of flowering, duration of flowering also is a varietal character influenced by climatic conditions of a particular region. Thus the time and duration of flowering vary with the varieties and the locality. The date of fruit setting varied from 29 April to 15 May in rainy season (Table 3) and 21 August to 2 September in winter season (Table 4), similarly, date of fruit harvesting varied from 19 July to 19 August in rainy season (Table 3) and 21 November to 04 December in

Table 2. Flower initiation, flower ending and flower duration of different guava varieties under semi-arid condition of Haryana during.

Varieties	Date of flower initiation	Date of flower ending	Flower duration (days)
Aishwariya	11 August	30 September	49
Allahabad safeda	14 August	29 September	48
Arka kiran	13 August	30 September	48
Arka mridula	12 August	02 October	51
Banarsi surkha	11 August	30 September	50
Barf khana	12 August	30 September	49
Hisar safeda	10 August	27 September	47
Hisar surkha	12 August	30 September	49
KG guava	16 August	Scattering flowering upto February	Could not be specified
Lalit	15 August	Scattering flowering upto February	Could not be specified
L-49	14 August	03 October	50
Pant parbhat	18 August	Scattering flowering upto February	Could not be specified
Pant red	12 August	02 October	51
Punjab pink	13 August	02 October	50
Shweta	17 August	Scattering flowering upto February	Could not be specified

winter season (Table 4). The period of fruit ripening/maturity in different guava varieties varied from 81-

Table 3. Fruit setting, fruit harvesting and fruit ripening period of different guava varieties under semi-arid condition of Haryana during rainy season.

Varieties	Date of fruit setting	Date of fruit harvesting	Fruit ripening period (days)
Aishwariya	02 May	25 July	84
Allahabad safeda	29 April	19 July	81
Arka kiran	12 May	05 August	85
Arka mridula	30 April	23 July	84
Banarsi surkha	11 May	02 August	83
Barf khana	06 May	30 July	85
Hisar safeda	03 May	28 July	86
Hisar surkha	08 May	02 August	86
KG guava	14 May	16 August	94
Lalit	09 May	01 August	84
L-49	08 May	02 August	86
Pant parbhat	15 May	19 August	96
Pant red	02 May	26 July	85
Punjab pink	05 May	30 July	86
Shweta	14 May	17 August	95

Table 4. Fruit setting, fruit harvesting and fruit ripening period of different guava varieties under semi-arid condition of Haryana during winter season.

Varieties	Date of fruit setting	Date of fruit harvesting	Fruit ripening period (days)
Aishwariya	22 August	25 November	95
Allahabad safeda	23 August	22 November	93
Arka kiran	27 August	29 November	94
Arka mridula	23 August	24 November	93
Banarsi surkha	24 August	28 November	96
Barf khana	26 August	27 November	93
Hisar safeda	21 August	21 November	92
Hisar surkha	27 August	29 November	94
KG guava	31 August	04 December	95
Lalit	28 August	29 November	93
L-49	27 August	29 November	94
Pant parbhat	02 September	08 December	97
Pant red	23 August	24 November	93
Punjab pink	25 August	27 November	94
Shweta	01 September	06 December	96

96 days during rainy season (Table 3) and from 92-97 days in winter season (Table 4).

The climate during winter was mild as compared to that of rainy season which perhaps prolonged the duration of fruit maturity/ripening during winter season. Kumari and Thakur (2016) observed the longest maturity period in Allahabad Safeda and

Table 5. Fruit skin color and fruit pulp color of different guava varieties under semi-arid condition of Haryana.

Varieties	Fruit skin color	Fruit pulp color
Aishwariya	Yellowish with red blush	Creamy-white
Allahabad safeda	Yellowish-green	White
Arka kiran	Yellowish-green	Pink
Arka mridula	Yellowish-green	White
Banarsi surkha	Yellowish-green	Pink
Barf khana	Yellowish-green	Creamy-white
Hisar safeda	Yellowish-green	White
Hisar surkha	Yellowish-green	Pink
KG guava	Greenish	Creamy-white
Lalit	yellowish-saffron with red blush	Pink
L-49	Greenish	White
Pant parbhat	Yellowish-green	White
Pant red	Yellowish-saffron color	Pink
Punjab pink	Yellowish-green	Pink
Shweta	Greenish	Creamy-white

Table 6. Fruit surface and fruit shape of different guava varieties under semi-arid condition of Haryana.

Varieties	Fruit surface	Fruit shape
Aishwariya	Rough with ridge	Round
Allahabad safeda	Smooth	Round
Arka kiran	Rough with ridge	Oblong
Arka mridula	Smooth	Round
Banarsi surkha	Rough with ridge	Ovate
Barf khana	Smooth	Globose
Hisar safeda	Smooth	Round
Hisar surkha	Smooth	Round
KG guava	Rough	Pear shape
Lalit	Smooth	Round
L-49	Rough with ridge	Oblong
Pant parbhat	Smooth	Ovate
Pant red	Smooth	Oblong
Punjab pink	Rough with ridge	Pear shape
Shweta	Rough with ridge	Round

Hybrid-1 was earliest in maturity followed by Lalit and Hybrid-3. It appears that like time of fruit ripening/maturity is a varietal character influenced by climatic conditions of a particular region. Thus the time and duration of fruit ripening/maturity vary with the varieties and the locality. Varieties are grouped into different categories on basis of pulp color (Table 5) viz., white pulp color varieties i.e. - Allahabad Safeda, Arka Mridula, Hisar Safeda, L-49, Pant Par-

Table 7. Fruit length, fruit width and fruit weight of different guava varieties under semi-arid condition of Haryana during rainy season.

Varieties	Fruit length (cm)	Fruit width (cm)	Fruit weight (g)
Aishwariya	7.02	6.27	92.4
Allahabad safeda	5.01	4.95	51.3
Arka kiran	5.17	5.06	59.9
Arka mridula	5.13	5.01	55.0
Banarsi surkha	5.02	5.15	59.4
Barf khana	5.44	6.26	89.6
Hisar safeda	5.25	5.30	72.7
Hisar surkha	5.20	5.15	66.3
KG guava	10.05	8.16	362.0
Lalit	5.22	5.20	69.8
L-49	7.03	6.28	92.9
Pant parbhat	5.28	6.08	81.8
Pant red	6.20	5.39	86.3
Punjab pink	6.10	5.32	82.6
Shweta	6.98	5.89	90.5
CD at 5%	0.23	0.30	5.1
Ranges	5.01 - 10.05	4.95 - 8.16	51.3 - 362.0

Table 8. Fruit length, fruit width and fruit weight of different guava varieties under semi-arid condition of Haryana during winter season.

Varieties	Fruit length (cm)	Fruit width (cm)	Fruit weight (g)
Aishwariya	8.04	7.17	110.0
Allahabad safeda	5.66	5.62	60.7
Arka kiran	5.82	5.71	69.1
Arka mridula	5.75	5.63	63.1
Banarsi surkha	5.67	5.77	68.3
Barf khana	6.08	6.99	101.8
Hisar safeda	5.90	6.00	83.9
Hisar surkha	5.82	5.75	75.3
KG guava	11.25	9.13	412.3
Lalit	5.84	5.82	79.7
L-49	8.07	7.20	111.2
Pant parbhat	5.88	6.80	91.9
Pant red	6.94	6.03	100.1
Punjab pink	6.84	5.95	94.2
Shweta	7.72	6.70	103.3
CD at 5%	0.26	0.29	4.9
Ranges	5.66 -11.25	5.62 - 9.13	60.7- 412.3

bhat, creamy- white pulp color varieties - Aishwariya, Barf Khana, KG Guava and Shweta. Pink pulp color varieties - Arka Kiran, Banarsi Surkha, Hisar Surkha, Lalit, Pant Red, Punjab Pink. These types of variation in pulp of the guava fruit found by Shalu *et al.* (2017). Variations in fruit pulp color in different varieties might be due to genetic background, climatic condition and nutritional status of the fruit, whereas, Skin color (Table 5) of ripe/mature fruits showed considerable variation as greenish, yellowish-saffron, yellowish saffron with red blush, yellowish-green and greenish with red blush during both the season. These types of variation in skin color of the guava fruit found by Shalu *et al.* (2017), Sharma *et al.* (2010) and Sahoo *et al.* (2017).

The shape of guava fruit (Table 6) varied from round, oblong, ovate, globose and pear shape. The round fruits of Hisar Safeda and Allahabad Safeda have also been reported by Shalu *et al.* (2017), Sharma *et al.* (2010), Meena *et al.* (2013) and Pandey *et al.* (2016) in guava. The similar type of variations in the fruit characters were also observed by Sahoo *et al.* (2017) and Sharma *et al.* (2010).

The surface of guava fruit (Table 6) varied from

rough, rough with ridge and smooth. The similar variations in the fruit characters were also observed by Shalu *et al.* (2017) and Sharma *et al.* (2010).

The length of guava fruit during both the seasons i.e. rainy (Table 7) and winter (Table 8) was found maximum in KG Guava, whereas, minimum was observed in Allahabad Safeda. Although, the diameter (width) of fruit is positively correlated with fruit length. The fruit weight was observed maximum in KG Guava during rainy (Table 7) and winter season (Table 8), respectively, while, during both the season minimum fruit weight was observed in Allahabad Safeda. Similar type of variations was observed by Sahoo *et al.* (2017). The variations in fruit length, width (diameter) and weight among the different varieties under different agro-climatic conditions might be due to their genetic makeup, prevailing climatic condition and/or the interaction effect of variety with the environment.

CONCLUSION

The present study concluded that the initial flowering was observed in case of Allahabad Safeda, while, late flowering was observed in Pant Parbhat during rainy season, whereas, During winter season, Pant Parbhat, KG Guava, Shweta and Lalit showed unspecified flowering duration. Allahabad Safeda, Barf Khana, Hisar Surkha, Lalit, Pant Parbhat, Pant Red, Arka Mridula, Hisar Safeda had smooth surface of fruit. In case of fruit shape, Aishwariya, Allahabad Safeda, Arka Mridula, Hisar Safeda, Hisar Surkha, Lalit, Shweta had round shape of fruits. KG Guava had maximum fruit length, fruit width and fruit weight during both the seasons. Varieties such as Allahabad Safeda, Arka Mridula, Hisar Safeda, L-49, Pant Parbhat had white color of fruit pulp Whereas, pink colored of fruit pulp was observed in Arka Kiran, Banarsi Surkha, Hisar Surkha, Lalit, Pant Red, Punjab Pink.

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