

Original Research Article

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Studies on Morphological Traits of Jackfruit (*Artocarpus heterophyllus* Lam.) Germplasm under *tarai* Conditions of Uttarakhand, India

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The present investigation was conducted to study the morphological traits of Jackfruit germplasm under *tarai* conditions of Uttarakhand in plot No. 6 of HRC, Patharchatta, GBPUA&T, Pantnagar, U.S. Nagar (Uttarakhand) from November, 2015 to July, 2016. The germplasms were planted in four rows. The experiment was conducted in Randomized Block Design with ten treatments and three replications consisted of ten germplasm viz., Jackfruit Germplasm-1, Jackfruit Germplasm-2, Jackfruit Germplasm-3, Jackfruit Germplasm-4, Jackfruit Germplasm-5, Jackfruit Germplasm-6, Jackfruit Germplasm-7, Jackfruit Germplasm-8, Jackfruit Germplasm-9 and Jackfruit Germplasm-10. The results showed regarding the morphological characters Jackfruit Germplasm-6 and Jackfruit Germplasm-8 are found to be short stature, having spreading habit. On the basis of above study, it can be concluded that there was significant variation in morphological character of various germplasm of Jackfruit. Among the various germplasm; Jackfruit Germplasm-6 and Jackfruit Germplasm-8 in dwarfness, spreading and yield found to be superior.

Introduction

Jackfruit (*Artocarpus heterophyllus* Lam.) is one of the most significant and widely grown fruit trees in tropical region. It belongs to the family Moraceae. It is one of the most popular and important fruits in India and considered to be the largest fruit in the world. The genus *Artocarpus* contains 8 species which bear edible fruits. Among them only two of them have horticultural importance viz. Jackfruit (*Artocarpus heterophyllus* Lam.) and bread fruit (*Artocarpus altilis*). It is originated to Western Ghats of India (Samaddar, 1990) and then spreaded to Malaysia and East Africa (Dutton, 1976). At present it is cultivated in

India, Bangladesh, Burma and Southern China and to a limited extent in Queensland (Australia) and Mauritius. Jackfruit is an evergreen tree typically reaching a height of 8-25m having long tap root and a dense crown (Bose and Mitra, 1990). The trunk is usually about 80-120 cm in diameter and can be much wider in older trees. The leaves are spirally arranged, simple, with large petiole covering the flower bud (Hayes, 1953). It is considered as a multipurpose fruit tree because each and every part of it is utilized. The succulent and aromatic fruit is eaten fresh or preserved in various ways. Pulp of the fruit is eaten fresh and tender fruit is also used as a popular vegetable. The jackfruit bulb of young fruit

contains 11.90% protein, 58.00% carbohydrate, 4.70% minerals and 0.014% vitamin C whereas, the ripe fruit contains 4.80% protein, 82.50% carbohydrate, 82.40% sugar and 3.50% minerals, vitamin C and A (0.007% and 0.10%, respectively) (Azad and Haque, 1999). The fruit also contains 250-1740 µg carotene per 100 g of pulp (Hossain and Haque, 1979). In India there is large variation in the characterization of jackfruit, still little work has been done in this aspect. In India mainly two types, soft fleshed and firm fleshed are available.

The farmers of our country are less aware about the type of Jackfruit, which is more demandable for export or what are the optimum times of harvesting of different types of jackfruit. The growers are also not aware what kinds of jackfruit are used in industries and which ones are used for normal purposes.

Thus knowledge on morphological characters of different types of jackfruit would help the growers to identify actual characters of good quality jackfruit for using different purposes. Therefore, the present investigation entitled "Studies on morphological traits of Jackfruit germplasm under *tarai* conditions of Uttarakhand" has been undertaken.

Materials and Methods

The present investigation was conducted to study the morphological traits of Jackfruit germplasm under *tarai* conditions of Uttarakhand in plot No. 6 of HRC, Patharchatta, GBPUA&T, Pantnagar, U.S. Nagar (Uttarakhand) from November, 2015 to July, 2016. Geographically, Pantnagar is situated at the foot hills of the Himalaya at 29° North latitude and 79.3 ° East longitudes and an altitude of 243.84 m above mean sea level. The climate of Pantnagar is humid subtropical with highest temperature ranging from 32°C to 43°C in summer and lowest (0°C to 9°C) in

winter. The frost occurrence is expected from last week of December to the last February.

Observations recorded

Plant height

The plant height was measured with the help of measuring pole from the ground level to the highest crown level and expressed in meters (m).

Stem girth

The stem girth was measured at 15 cm above the ground level using a measuring tape and expressed in centimeter.

Canopy spread

The spread of the each tree was measured in both the direction of East-West and North-South and calculated by the formula and expressed in meters (m).

$$\text{Tree spread} = \frac{(N-S) + (E-W)}{2}$$

Where:

(N-S) = North-South

(E-W) = East- West

Tree volume

The tree volume was calculated by using the following formula given by Westwood *et al.*, (1983) and expressed in m³.

$$\text{Tree volume} = \frac{4}{3}\pi a^2 b$$

Where,

a= Half of the spread

b= Half of the height

Cross sectional area of the trunk

The girth of the trunk was taken at fifteen centimeters above the ground level and was converted into cross sectional area by the following formula given by Glenn and Rogers (1964).

$$\text{Cross sectional area of trunk} = \frac{(\text{Girth})^2}{4\pi}$$

Length and width of the leaf

The length of the leaves was measured from the base to the tip and the width of the leaves was measured at the point of maximum width of the leaf with the help of measuring scale in centimeters and mean value were computed.

Fresh and dry weight of leaves

Ten leaf samples from all the direction was collected from each genotype and fresh weight of the leaf was taken. The samples were dried in a hot air oven at 80°C for 48 hours and dry weights of leaves was determined and mean value was worked out and it was expressed in g/plant.

Leaf area

Leaf area was measured with the help of leaf area meter (LI-COR portable leaf area meter LI-3000 A) and the mean leaf area was presented in cm².

Results and Discussion

The maximum height (9.66 m) of the tree was recorded in Jackfruit Germplasm-1 followed by Jackfruit Germplasm-2 (9.33 m), but these two germplasm were statistically *at par* with respect to plant height. The information was similar with the findings of Singh *et al.*, (2011) who reported that jackfruit plant height to be ranged from 7.8 m to 11.3 m. Rai *et al.*,

(2003) revealed that, plant height of different genotypes ranged from 5.6 m to 9.05 m and support this present study. Similar results were reported by Morton (1987).

The maximum girth (137.72 cm) of the tree was recorded in Jackfruit Germplasm-3 followed by Jackfruit Germplasm-9 (132.33 cm), but these two germplasm are statistically similar with respect to stem girth.

The findings are in conformity with those of Singh *et al.*, (2011); Rai *et al.*, (2003) and Morton (1987). The variation in stem girth of different germplasm might be due to genetic variability as well as agro-climatic condition.

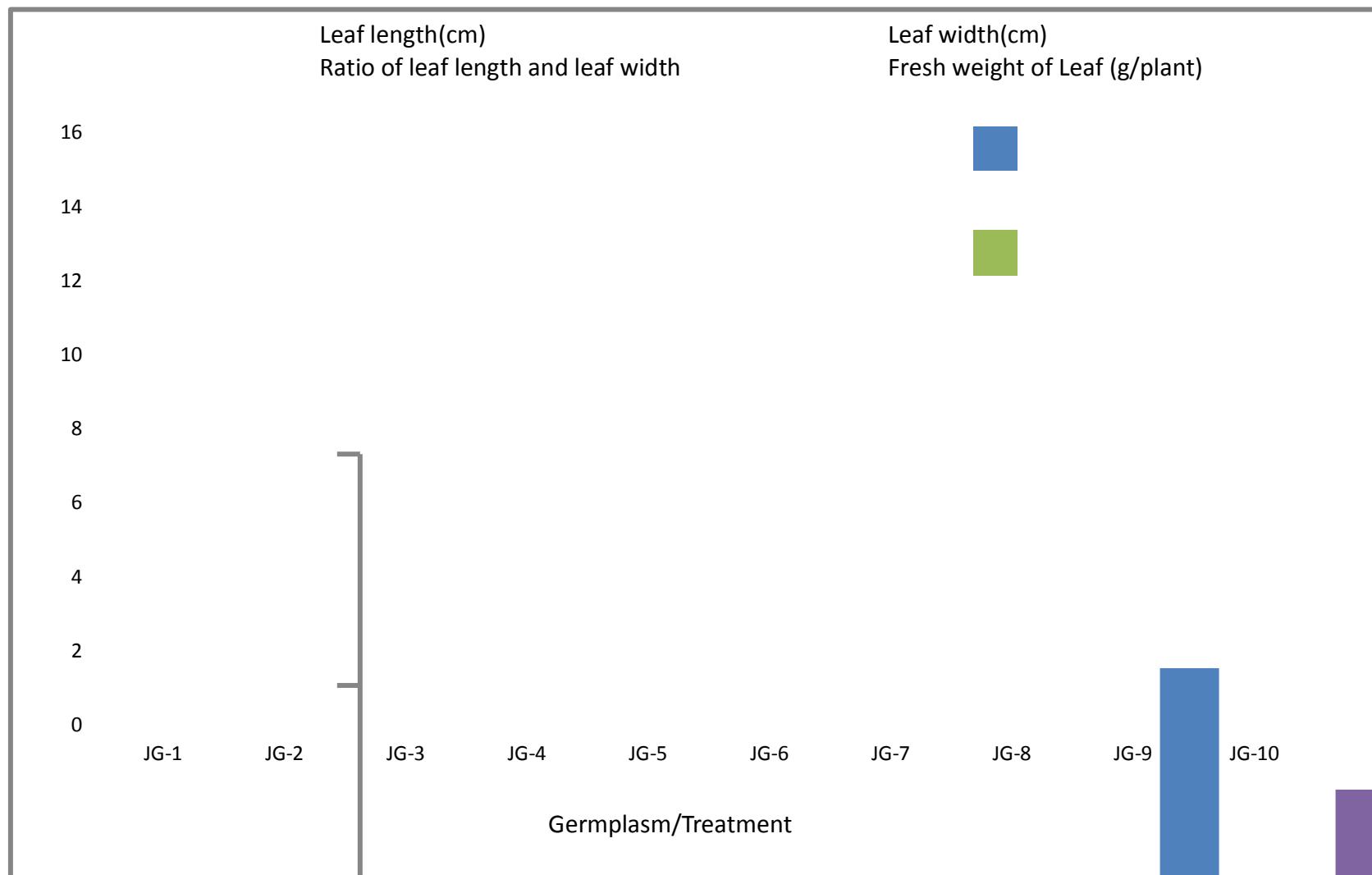
The maximum spread (8.49 m) of the tree was recorded in Jackfruit Germplasm-2 followed by Jackfruit Germplasm-8 (8.16 m) but these two germplasm were statistically similar with each other. These results are similar with the findings of Rai *et al.*, (2003) who observed that, plant spread of different germplasm varies from 4.45 m to 9.30 m.

Similarly, Ali *et al.*, (2015) found that the tree spread of different jackfruit germplasm varies from 7.8 m to 20 m and these support the present study. The variation is due to genetic variability and nutrient absorption ability of different germplasm.

The maximum tree volume (344.40 m³) was recorded in Jackfruit Germplasm-2 and the minimum volume (98.97 m³) was recorded in Jackfruit Germplasm-10 proceeded by Jackfruit Germplasm-4 (125.91 m³) which were statistically *at par* with each other. The findings of the present study showed that tree volume of different germplasm varied significantly and this variation may be due to genetic influence of different germplasm. The results were found similar to earlier findings of Khan *et al.*, (2010); Rai *et al.*, (2003); and Ali *et al.*, (2015) (Table 1).

Serial No.	Treatment/ Germplasm	Plant height (m)	Stem girth (cm)	Plant spread (m)	Tree volume (m ³)	CSTA (cm ²)	Leaf length (cm)	Leaf width (cm)	Leaf length width ratio	Fresh weight of Leaf (gram)	Dry weight of Leaf (gram)	Leaf area (cm ²)
1	<i>Jackfruit Germplasm-1</i>	9.66	109.24	6.38	208.85	969.59	12.20	8.06	1.52	10.50	1.50	833.62
2	<i>Jackfruit Germplasm-2</i>	9.33	98.62	8.49	344.40	781.97	9.71	6.03	1.61	8.33	2.51	659.01
3	<i>Jackfruit Germplasm-3</i>	9.16	137.72	6.35	194.38	1511.09	14.16	9.13	1.55	13.11	1.54	976.81
4	<i>Jackfruit Germplasm-4</i>	8.83	97.89	5.22	125.91	765.40	9.44	6.01	1.57	9.15	2.73	723.07
5	<i>Jackfruit Germplasm-5</i>	7.00	109.09	8.07	239.87	954.25	14.69	9.56	1.53	12.35	1.43	1005.18
6	<i>Jackfruit Germplasm-6</i>	5.90	102.88	6.33	124.57	843.13	9.20	5.50	1.67	8.77	2.19	519.78
7	<i>Jackfruit Germplasm-7</i>	7.50	85.23	7.13	200.62	584.19	13.26	8.48	1.57	10.30	2.88	783.72
8	<i>Jackfruit Germplasm-8</i>	5.16	114.42	8.16	180.77	1127.91	11.35	7.07	1.62	6.90	2.03	648.51
9	<i>Jackfruit Germplasm-9</i>	6.00	132.33	6.50	132.65	1416.80	11.89	7.19	1.65	9.48	2.19	744.38
10	<i>Jackfruit Germplasm-10</i>	6.86	82.95	4.53	98.97	559.72	10.88	6.32	1.72	7.86	1.47	556.15
S.E. (m).±		0.444	9.440	0.308	19.340	172.869	1.150	0.801	0.044	1.131	0.305	100.93
C.D. (5%)		1.319	28.048	0.917	57.465	513.640	3.417	2.380	NS	3.361	0.906	299.91

Fig.1 Effect of different Jackfruit germplasm on leaf length, leaf width, ratio of leaf length and width, fresh weight and dry weight of leaf



Maximum cross sectional area of the trunk (1511.09 cm^2) was recorded in Jackfruit Germplasm-3, while the minimum value (559.72 cm^2) was recorded in Jackfruit Germplasm- 10. The cross sectional area of the trunk is influenced by the girth of the tree and this significant variation due to variation in girth of the tree, which is controlled genetically. These results are in agreement with the findings of Chadha and Pareek (1989); Rai *et al.*, (2003); and Ali *et al.*, (2015).

The maximum leaf length (14.69 cm) was found in Jackfruit Germplasm-5 followed by Jackfruit Germplasm-3 (14.16 cm) and Jackfruit Germplasm-7 (13.26 cm) and they were statistically *at par* with each other while minimum leaf length (9.20 cm) was recorded in Jackfruit Germplasm-6. From the above study, it is clear that significant differences were established in leaf length of various germplasm and genetic variability causes this variation. The results coincide with the findings of Sarker and Zuberi (2011); Selvaraj and Pal (1989) and Chandrasekhar (2014) (Fig. 1).

The maximum leaf width (9.56 cm) found in Jackfruit Germplasm-5 followed by Jackfruit Germplasm-3 (9.13cm), Jackfruit Germplasm-7 (8.48cm) and they were statistically similar, while minimum leaf width (5.50 cm) was found in Jackfruit Germplasm-6. These results are also supported by Sarker and Zuberi (2011) who reported that, the width of leaves of jackfruit ranged from 4.64 cm to 13 cm. These findings are also in accordance with Chandrasekhar (2014) and the variation might be due to genetic variability.

The highest fresh weight (13.11g/plant) was recorded in Jackfruit Germplasm-3 followed by Jackfruit Germplasm-5(12.35g/plant), while the lowest value was recorded in

Jackfruit Germplasm-8 (6.90 g/plant) and remaining germplasm recorded intermediate values for fresh weight. These findings are in conformity with those of Shamsudin *et al.*, (2009) and Rahman *et al.*, (1994).

The highest dry weight (2.88 g/plant) was recorded in Jackfruit Germplasm-7 followed by Jackfruit Germplasm-4 (2.73g/plant) and they were statistically *at par* with each other. These results are supported by Shamsudin *et al.*, (2009) and Rahman *et al.*, (1994). The variation of the dry weight of leaves may be due to water content of the leaves of various germplasm.

Area of leaves was highest (1005.18 cm^2) for Jackfruit Germplasm-5 followed by Jackfruit Germplasm-3 (976.81 cm^2) and they were statistically *at par* with each other. The findings of Shamsudin *et al.*, (2009) and Rahman *et al.*, (1994) support the present study. The variation of leaf area may be due to the genetic makeup of different plant structure.

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