



Plant Archives

Journal homepage: <http://www.plantarchives.org>

DOI Url : <https://doi.org/10.51470/PLANTARCHIVES.2026.v26.supplement-2.224>

VARIETAL STUDY OF TUBEROSE (*Polianthes tuberosa* L.) FOR GROWTH AND YIELD

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(Date of Receiving : 06-04-2026; Date of Revision : 23-05-2026; Date of Acceptance : 07-06-2026)

ABSTRACT

The goal of this study was to evaluation of collected germplasm and identification of promising cultivars. Examine tuberose varietal performance in the unique agroclimatic conditions of West Bengal. In order to support selection efforts for better tuberose production in the West Bengal region, the study sought to identify high-performing varieties and quantify important genetic characteristics linked to yield and quality traits. Fifteen teen genotypes of tuberose were evaluated during 2016-17 and 2017-2018 in Randomized Complete Block Design with three replications. From the two years pooled data it was noticed that significant differences were observed among the genotypes for all vegetative, flowering and yield traits studied. Suckering ability among the genotypes ranged from 8.5 to 16.3 per plant. Highest sucker was noticed in Calcutta Single (16.3) which was followed by Bidhan Ujwal (15.5) and Bidhan Snigdha (13.5). Spike length ranged from 86 cm to 150 cm. longest spike was noticed in Sikkim Selection (150 cm) which was followed by (Bidhan Jyoti 129 cm), Prajwal (114 cm) and Bidhan Snigdha (113.5 cm). Rachis length ranged from 31 cm to 49.1 cm. longest rachis was noticed in Bidhan Snigdha (49.1 cm) which was followed by Sikkim Selection (46.7 cm) and Prajwal (43 cm). Maximum no. of florets per spike was noticed in Bidhan Ujwal (63.3) which was followed by Bidhan Snigdha (57.7). Thus, Bidhan Ujwal had maximum density of rachis among the genotypes. Floret length, floret weight and floret diameter was maximum in Bidhan Snigdha. Weight of floret per spike was also maximum in Bidhan Snigdha (170 gram per spike).

Keywords : Tuberose, Varieties, Spike characters, Yield.

Introduction

One of the most popular bulbous ornamental crops, tuberose (*Polianthes tuberosa* L., Family: Amaryllidaceae) is grown commercially for its fragrant and beautiful cut flowers as well as loose blossoms. The durable flower spikes are mostly utilized for bouquet creation, flower arrangement, and vase adornment. There is a huge demand for beautiful garlands and floral accessories made from loose flowers. The successful production of tuberose depends heavily on climatic conditions.

It is a prominent bulbous ornamental blooming plant found in tropical and subtropical regions, and both genetic and climatic factors have a significant impact. There are numerous outstanding tuberose

cultivars with magnificent full-length inflorescences, a wide range of flower sizes and numbers, and great keeping qualities. Commercial tuberose cultivation is becoming increasingly important; the introduction and identification of high-yielding cultivars are required. This study aimed to evaluate tuberose varieties for improved vegetative growth, cut flower yield, and loose flower production.

Materials and Methods

The experiment was conducted with 15 genotypes of tuberose viz. V₁: Shringar, V₂: Phule Rajani, V₃: Calcutta Double, V₄: Prajwal, V₅: Vaibhab, V₆: Calcutta Single, V₇: Sikim Selection, V₈: Hyderabad Single, V₉: Hybrid Gkct-4, V₁₀: Hyderabad Double, V₁₁: Arka Nirantara, V₁₂: Subhasini Double, V₁₃:

Bidhan Snigdha, V₁₄: Bidhan Ujwal, V₁₅: Bidhan Jyoti. were planted according to randomized block design with three replications number of bulbs per replication 30 bulbs were planted with a spacing of 45 cm x 30 cm. This experiment was conducted at Horticultural Research Station, Mandouri, Faculty of Horticulture, Bidhan Chandra Krishi Vishwavidyalaya, Nadia. The site of experiment is situated at 23°N latitude and 89°E longitudes at an elevation of 9.75 meters from mean sea level. Data were recorded for both vegetative and flowering attributes. Observations were recorded on all the indicating characters viz. Plant height(cm), No. of leaves/plant, No. of tiller/plant, Spike length(cm), Rachis length(cm), No. of florets/spike, Length of floret(cm), Diameter of floret(cm), Weight of 5 no. floret(g), Weight of floret/spike(gm), No. Of spikes/clump, No. Of spike /plot, No. of florets/spike, Individual Floret weight, No. of spike/plant, Yield/clump(g), Yield/ha (tones). All agro-techniques were followed as per recommendations of this University.

Results and Discussion

Vegetative characters like plant height, number of leaves per hill and number of tillers per hill differed significantly among the genotypes (Table 1).

Plant height (cm)

The plant height of different genotypes of tuberose varied and the data is presented in Table 1. The maximum plant height was observed in variety Calcutta Single (53.94 cm), which was at par with

Bidhan Snigdha (53.65 cm) as well as minimum in Arka Nirantara (40.60 cm) and Bidhan Jyoti (40.69 cm). The genotype's higher photosynthetic ability may account for the increased plant height. The variation in plant height may be caused by variations in the cultivar's genetic composition and diverse origins, which alter phenotypic expression in particular geographic locations. The results of variation in plant height due to genotypic differences and environmental variation are in agreement with the findings of Sateesha *et al.* (2011), Ranchana *et al.* (2015) and Dimri (2017) in tuberose.

No. of leaves/plant

Data on the number of leaves per plant, showing that the number of leaves produced by different tuberose genotypes varied significantly both in the experiment year and on a pooled basis shown in Table 1.

Leaves are the principal photosynthetic sites, which have a significant impact on crop development and productivity. A greater number of leaves was reported in Calcutta Single (103.50). In contrast, fewer leaves were noted in Sikim Selection (38.84). The variation in number of leaves per hill is attributed by the hereditary traits which are further modified by the environmental factors like temperature, relative humidity and light intensity, which has been in accordance with the findings of Ramachandrudu and Thangam (2009), Mahawer *et al.* (2013), Desai and Chawla (2010) in tuberose.

Table 1 : Agro-morphological characters of tuberose genotypes maintained at BCKV Centre.

Name of the varieties	Plant height (cm)			No. of leaves/plant			No. of tiller/plant			Spike length (cm)		
	I			II			III			IV		
	2016-17	2017-18	Mean	2016-17	2017-18	Mean	2016-17	2017-18	Mean	2016-17	2017-18	Mean
V ₁	45.50	43.67	44.59	50.00	59.33	54.67	10.00	12.67	11.34	97.10	91.33	94.22
V ₂	44.63	43.33	43.98	51.00	60.67	55.84	11.00	14.00	12.50	93.00	87.33	90.17
V ₃	43.07	42.00	42.54	48.00	58.33	53.17	11.00	13.00	12.00	93.00	88.00	90.50
V ₄	51.23	50.33	50.78	54.33	64.33	59.33	8.33	10.33	9.33	119.77	108.67	114.22
V ₅	41.03	40.33	40.68	45.33	61.33	53.33	8.33	9.67	9.00	91.67	88.67	90.17
V ₆	55.20	52.67	53.94	114.33	92.67	103.50	15.00	17.67	16.34	104.67	100.67	102.67
V ₇	49.67	49.33	49.50	39.67	38.00	38.84	8.33	11.00	9.67	159.33	140.67	150.00
V ₈	44.70	44.00	44.35	50.67	47.33	49.00	10.67	11.67	11.17	95.20	91.00	93.10
V ₉	44.77	43.67	44.22	49.33	53.33	51.33	10.00	11.67	10.84	83.00	80.67	81.84
V ₁₀	43.77	43.33	43.55	48.67	56.33	52.50	9.67	10.67	10.17	114.00	107.00	110.50
V ₁₁	41.20	40.00	40.60	62.67	74.33	68.50	9.67	11.67	10.67	112.33	102.00	107.17
V ₁₂	41.10	40.33	40.72	49.33	54.33	51.83	9.67	12.00	10.84	118.00	110.33	114.17
V ₁₃	53.97	53.33	53.65	47.67	61.00	54.34	12.67	14.33	13.50	115.67	111.33	113.50
V ₁₄	45.20	44.67	44.94	63.33	73.33	68.33	14.67	16.33	15.50	88.97	83.00	85.99
V ₁₅	40.37	41.00	40.69	39.67	49.67	44.67	7.33	9.67	8.50	134.67	123.33	129.00
SE (±)	0.63	1.09		2.15	2.18		0.43	1.12		1.5	1.76	
CD at 5%	1.86	3.3		6.38	6.47		1.29	3.36		4.46	5.23	
CV (%)	2.37	4.2		6.86	6.26		7.21	15.56		2.41	3.02	

V₁: Shringar, V₂: Phule Rajani, V₃: Calcutta Double, V₄: Prajwal, V₅: Vaibhab, V₆: Calcutta Single, V₇: Sikim Selection, V₈: Hyderabad Single, V₉: Hybrid Gktc-4, V₁₀: Hyderabad Double, V₁₁: Arka Nirantara, V₁₂: Subhasini Double, V₁₃: Bidhan Snigdha, V₁₄: Bidhan Ujwal, V₁₅: Bidhan Jyoti

No. of tiller/plant

The number of tillers per hill was the greatest in Calcutta Single (16.34) followed by Bidhan Ujwal (15.50). The differential response with regard to the vigorous growth might be due their genetic makeup.

Spike length(cm)

Tuberose has become popular as a cut flower due to its gorgeous, elegant, and fragrant spikes. It is the perfect cut flower because of its long spike and many closely spaced flowers. Longer spike length is a desirable character for cut flower. In the current investigation, longer spikes were found in Sikim Selection (150.00 cm). whereas lowest spike length was observed in Hybrid Gkct-4 (81.84 cm).

These variations may have longer spikes because of greater internodal spacing. Susila (2013), Krishnamoorthy (2014), Prakash *et al.* (2015), and Bindiya *et al.* (2018) all report the variance in spike length. Genetic characteristics and current environmental factors may be the cause of this difference in spike length. The firmness and strength of the spike are determined by the peduncle's girth. In vases, a sturdy and robust peduncle will offer more mechanical support.

Rachis length (cm)

In order to give the spike a compact appearance, a lengthy rachis with more closely spaced florets is preferred. The length of the rachis and the number of florets per spike are strongly related; the longer the rachis, the more florets there are on the spike. The rachis length of the types under investigation varied significantly. There was a longer rachis in Bidhan Snigdha (49.09 cm) which was on par with sikim selection (46.67 cm) and Prajwal (43.00 cm). This variation among cultivars might be due to genetic traits and prevailing climatic conditions. The findings are in accordance with Singh and Singh (2013) and Ranchana *et al.* (2013) in tuberose.

Floral parameters (No. of florets/spike, Length of floret (cm), Diameter of floret(cm))

Floral metrics such as floret quantity, length, diameter, and weight are crucial for determining flower quality. The two-year pooled data (Table 2) revealed that maximum trend for number of florets per spike

(62.33) which was on par with Bidhan Snigdha (57.67) Phule Rajani (52.50), Culcutta Double (52.00) and Prajwal (51.34). Patil *et al.* (2009) and Mahawer *et al.* (2008) found significant heterogeneity in the number of florets per spike across tuberose cultivars, which aligns with our findings.

For the better appearance of spike, it should have larger florets. As the diameter of the floret increases, the tendency of crowding by overlapping will increase; this will further enhance the beauty of the spike. In the current experiment, higher length of florets was observed in Bidhan Snigdha (7.27 cm) which was statistically on par with Prajwal (6.30 cm), Arkanirantara (6.19 cm) and Calcutta Single (6.00 cm). The greater floret diameter was in Bidhan Snigdha (6.22 cm) which were on par with Subhasini (5.50 cm). Bindiya *et al.* (2018) reported a similar in tuberose result. The climatic conditions during the growing season and variations in genetic composition may be the cause of floret size variation. Increased floret size is also a result of the bud accumulating more carbohydrates.

The cultivar Subhasini Double performed better in floral qualitative traits like Weight of 5 no. floret (20.99 g) which was followed by Hyderabad Double (19.14 g) (Table 3).

Yield Parameters

Weight of florets spike-1 (g)

Table 3 shows the experiment data on the weight of florets per spike influenced by several tuberose cultivars.

The data clearly depicted that maximum weight of florets per spike (170.50 g) was recorded in cultivar Bidhan Snigdha. Variations in Weight of floret/spike may be attributed to genetic differences between cultivars or environmental circumstances. The current results are consistent with the gladiolus findings of Kumar and Yadav (2005). This variation in the weight of florets per spike may be due to varietal character and environmental condition. It was also concluded that this parameter is in direct relation with weight of individual floret. This has been confirmed by Patil *et al.* (2009) for maximum weight of flower spike (152.6 g) in Prajwal to support this present study.

Table 2 : Agro-morphological characters of tuberose genotypes maintained at BCKV Centre.

Name of the varieties	Rachis length(cm)			No. of florets/spike			Length of floret(cm)			Diameter of floret(cm)		
	V			VI			VII			VIII		
	2016-17	2017-18	Mean	2016-17	2017-18	Mean	2016-17	2017-18	Mean	2016-17	2017-18	Mean
V ₁	42.03	37.33	39.68	52.00	49.33	50.67	6.03	5.93	5.98	4.47	4.13	4.30
V ₂	35.67	36.67	36.17	53.67	51.33	52.50	5.70	5.47	5.59	5.10	5.00	5.05

V ₃	35.67	33.33	34.50	53.67	50.33	52.00	5.70	5.43	5.57	5.10	4.97	5.04
V ₄	44.00	42.00	43.00	52.67	50.00	51.34	6.47	6.13	6.30	5.33	5.10	5.22
V ₅	35.57	35.53	35.55	40.67	39.33	40.00	5.13	5.07	5.10	5.03	4.87	4.95
V ₆	33.77	39.00	36.39	35.33	35.33	35.33	6.07	5.93	6.00	3.43	3.30	3.37
V ₇	41.00	52.33	46.67	47.33	47.33	47.33	5.83	5.60	5.72	4.33	4.17	4.25
V ₈	33.00	34.33	33.67	50.67	48.00	49.34	5.83	5.67	5.75	4.47	4.23	4.35
V ₉	32.00	30.33	31.17	48.67	45.33	47.00	5.73	5.60	5.67	5.10	5.03	5.07
V ₁₀	37.53	40.33	38.93	46.00	43.00	44.50	5.57	5.43	5.50	5.43	5.33	5.38
V ₁₁	41.10	39.67	40.39	50.00	48.00	49.00	6.27	6.10	6.19	5.27	5.07	5.17
V ₁₂	40.33	41.00	40.67	52.00	50.67	51.34	5.87	5.57	5.72	5.67	5.33	5.50
V ₁₃	52.17	46.00	49.09	59.33	56.00	57.67	7.40	7.13	7.27	6.33	6.10	6.22
V ₁₄	34.27	30.00	32.14	63.33	61.33	62.33	6.03	6.00	6.02	4.53	4.37	4.45
V ₁₅	34.10	49.33	41.72	47.33	45.00	46.17	6.07	5.93	6.00	4.80	4.40	4.60
SE(±)	0.63	1.27		0.99	1.2		0.04	0.14		0.04	0.09	
CD at 5%	1.87	3.78		2.93	3.57		0.11	0.43		0.12	0.28	
CV(%)	2.86	5.24		3.4	4.24		1.11	4.28		1.45	3.41	

V1: Shringer, V2: Phule Rajani, V3: Calcutta Double, V4: Prajwal, V5: Vaibhab, V6: Calcutta Single, V7: Sikim Selection, V8: Hyderabad Single, V9: Hybrid Gkct-4, V10: Hyderabad Double, V11: Arkanirantara, V12: Subhasini Double, V13: Bidhan Snigdha, V14: Bidhan Ujwal, V15: Bidhan Jyoti

Yield of spikes per clump

Table 3 displays the data on the production of spikes per clump, which was recorded in both experimental years and in a pooled mean. The range was 1.42 to 3.05. The results showed that, in both the experimental years and the pooled mean basis, different genotypes varied considerably in tuberose to yield of spikes per clump. Cultivar Bidhan Ujwal (3.05) resulted significantly highest yield of spikes per clump, which was followed by Phule Rajani (2.75), Shringer (2.64) and Calcutta Single (2.58). The more production of spikes has direct relation with better vegetative growth of the plants, which leads to the production of a greater number of spikes per plant; in turn it results in increased spike yield per plant and per

hectare. These results were also experimentally supported by the findings of Dalvi *et al.* (2021), Sateesha *et al.* (2011) and Krishnamoorthy (2014) tuberose.

No. Of spike /plot

The data measured to yield of spikes plot-1 as shown by different cultivars of tuberose had been presented in table 3. The result depicted in table 3. clearly revealed that significantly highest yield of spikes per plot (251.7) was registered in cultivar Bidhan Ujwal. It was noted followed by Phule Rajani (233.2). Yield of spikes plot-1 is directly correlated with yield of spike per plant. These results were also experimentally supported by the findings of Gorivale *et al.* (2020) and Dalvi *et al.* (2021) in tuberose.

Table 3 : Agro-morphological characters of tuberose genotypes maintained at BCKV Centre.

Name of the varieties	Weight of 5 no. floret(g)			Weight of floret/spike(gm)			No. Of spikes /clump			No. Of spike /plot		
	IX			X			XI			XII		
	2016-17	2017-18	Mean	2016-17	2017-18	Mean	2016-17	2017-18	Mean	2016-17	2017-18	Mean
V ₁	7.30	7.00	7.15	80.50	80.50	80.50	2.60	2.67	2.64	266	197	231.5
V ₂	7.37	7.17	7.27	76.17	76.17	76.17	2.50	3.00	2.75	247	219.3	233.2
V ₃	19.20	16.67	17.94	76.17	76.17	76.17	1.82	2.33	2.08	184	194	189.0
V ₄	12.40	11.33	11.87	124.00	120.67	122.34	1.09	2.33	1.71	107	129.7	118.4
V ₅	16.73	15.00	15.87	71.00	67.33	69.17	1.70	2.00	1.85	171	198.7	184.9
V ₆	5.73	5.23	5.48	60.00	56.67	58.34	2.15	3.00	2.58	214	224	219.0
V ₇	5.57	5.20	5.39	146.00	128.00	137.00	0.84	2.00	1.42	83	197.7	140.4
V ₈	7.73	7.33	7.53	81.10	78.00	79.55	2.03	2.33	2.18	204	231.7	217.9
V ₉	7.63	7.57	7.60	77.30	75.00	76.15	2.37	2.73	2.55	238	216.3	227.2
V ₁₀	20.60	17.67	19.14	110.00	102.33	106.17	1.77	2.00	1.89	176	196.3	186.2
V ₁₁	9.07	9.07	9.07	70.03	62.33	66.18	1.94	2.00	1.97	192	211	201.5
V ₁₂	22.30	19.67	20.99	141.67	131.67	136.67	1.83	1.97	1.90	180	201.3	190.7
V ₁₃	13.17	11.00	12.09	181.00	160.00	170.50	2.00	3.33	2.67	201	231.7	216.4
V ₁₄	7.67	7.67	7.67	91.00	88.33	89.67	2.43	3.67	3.05	242	261.3	251.7
V ₁₅	4.40	4.30	4.35	113.63	102.67	108.15	2.17	3.00	2.59	216	234	225.0

SE(±)	0.21	0.48		1.81	1.76		0.06	0.25		3.57	5.43	
CD at 5%	0.62	1.43		5.36	5.22		0.16	0.75		10.6	15.9	
CV(%)	3.23	8.24		3.13	3.25		4.91	15.78		3.81	5.0	

V1: Shringer, V2: Phule Rajani, V3: Calcutta Double, V4: Prajwal, V5: Vaibhav, V6: Calcutta Single, V7: Sikkim Selection, V8: Hyderabad Single, V9: Hybrid Gktc-4, V10: Hyderabad Double, V11: Arka Nirantara, V12: Subhasini Double, V13: Bidhan Snigdha, V14: Bidhan Ujwal, V15: Bidhan Jyoti

No. of florets/spike

Table 4 displays the data on the production of number of florets per spike, which was recorded in both experimental years and in a pooled mean. The results showed that, in both the experimental years and the pooled mean basis, different genotypes varied considerably in tuberosity to number of florets per spike. Cultivar Bidhan Ujwal (62.33) resulted significantly highest number of florets per spike which was followed by Bidhan Snigdha (57.67).

Yield/clump(g) and Yield/ha (tones)

The results, which were displayed in Table 4, demonstrated variations between various tuberose cultivars for the quantity of Yield/clump and Yield/ha (tones). Data revealed that highest maximum Yield/clump was recorded in Subhasini Double (409.7 g). This cultivar was followed by cultivar Calcutta Double

(387.2 g). On the other hand, cultivar Sikkim Selection had the lowest Yield/clump (71.9 g). However, Dalvi *et al.* (2021) also found similar patterns for bulb yield plot-1 and bulb yield ha⁻¹, recording greatest bulb yield plot-1 (3.54) & bulb yield ha⁻¹ (13.28 t/ha) in cv. Prajwal.

The current study's findings made it abundantly evident that Subhasini Double produced the highest Yield/ha (32.7). Additionally, it is evident from the data that Calcutta Double (30.9) and Bidhan Snigdha (29.6) came after Subhasini Double. While cultivar Calcutta Single produced the lowest yield ha⁻¹ (7.9). Variation in bulbs per plant per ha due to genetic character and prevailing environmental conditions has also been observed by Dalvi *et al.* (2021), Krishnamoorthy (2014), Singh and Singh (2013) and Chaturvedi *et al.* (2014) in tuberose.

Table 4 : Agromorphological characters of tuberose genotypes maintained at BCKV Centre.

Genotypes	No. of florets/spike	Individual Floret weight	No. of spike/plant	Yield/clump (g)	Yield/ha (tones)
V1: Shringer	50.67	1.43	2.64	191.3	15.3
V2: Phule Rajani	52.50	1.45	2.75	209.3	16.7
V3: Calcutta Double	52.00	3.58	2.08	387.2	30.9
V4: Prajwal	51.34	2.37	1.71	208.1	16.6
V5: Vaibhab	40.00	3.17	1.85	234.6	18.2
V6: Calcutta Single	35.33	1.09	2.58	99.4	7.9
V7: Sikkim Selection	47.33	1.07	1.42	71.9	5.8
V8: Hyderabad Single	49.34	1.50	2.18	161.3	12.8
V9: Hybrid Gktc-4	47.00	1.50	2.55	180.0	14.4
V10: Hyderabad Double	44.50	3.82	1.89	321.3	25.6
V11: Arkanirantara	49.00	1.81	1.97	174.7	13.9
V12: Subhasini Double	51.34	4.20	1.90	409.7	32.7
V13: Bidhan Snigdha	57.67	2.41	2.67	371.1	29.6
V14: Bidhan Ujwal	62.33	1.53	3.05	290.9	23.3
V15: Bidhan Jyoti	46.17	0.87	2.59	104.0	8.3

Conclusion

From the present research study, it can be concluded that growth, yield and quality of tuberose is significantly influenced by various factors like genotype, season, prevailing environmental conditions etc. Among these factors, genetic makeup themselves contributes much to their performance.

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