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Testing of genotypes in tuberose (Double type) for cut flower varieties under Pune conditions

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Abstract

An investigation on 'Testing of genotypes in tuberose (Double type) for cut flower varieties under Pune conditions' was carried out at All India Coordinated Research Project, Zonal Agricultural Research Station Ganeshkhind Pune-67 (Maharashtra, India) during three years (2018-19 to 2020-21) in randomized block design with six treatments and three replications. The results revealed that among the six double type tuberose genotypes the genotype Local Double recorded significantly more spike length (105.42 cm), length of floret (6.59 cm) and weight of spike (132.12 g). The cv. Arka Suvasini recorded significantly more rachis length (51.86 cm). However, the cv. Phule Rajat recorded more number of florets per spike (44.08) which is at par with cv Arka Suvasini (42.17) and Vaibhav (42.00). Maximum number of spikes (9.08) per plant was recorded by Phule Rajat which was at par with BRH-24 (7.75). Finally, it can be concluded that among the different varieties of Tuberose under study, variety Phule Rajat was found superior in respect of growth, flower yield as well as quality parameters under Western Maharashtra particularly Pune condition.

Keywords: Tuberose, evaluation, growth, flower yield and quality

Introduction

Among the wide varieties of cultivated flowers, tuberose (*Polianthes tuberosa* L.), is one of the most important tropical ornamental bulbous flowering plants cultivated for production of long-lasting flower spikes. It belongs to the family Amaryllidaceae. Tuberose is native to Mexico from where it is spread to different parts of the world during 16th century. This plant being the tuberous hyacinth as distinguished from the bulbous hyacinth, the name thus is 'tuber-ose', not 'tube - rose'. Tuberose is half hardy, perennial bulbous plant. Bulbs are made of scales and leaf bases and stem remain concealed within scales. Roots are adventitious and shallow. Tuberose inflorescences (spikes) bear 25 ± 10 pairs of florets which open acropetally (i.e., from base to top of the spike). Flowers have a funnel shaped perianth and are fragrant, waxy white, about 25 mm long. Stamens are six in number, Tri locular ovary, ovules numerous and fruits are capsule (Anon., 2006) [1]. Polianthes genus contains three types of flowers. One of them is single flower type which is female fertile used in perfumery industry and breeding programme as female parent. The other two are semi-double and double flower types and generally used as cut flower. Due to their lingering delightful fragrance and charm, these flowers are adorned with vernacular names in India like Gulchari and Gulshabbo in Hindi, Rajanigandha in Bengali, Sukandaraji and Nelasampangi in Telugu, Nilasampangi in Tamil and as Sugandharaja in Kannada (Jawaharlal *et al.*, 2006) [7]. In India its commercial cultivation is confined to Maharashtra, Andhra Pradesh, Karnataka, Chhattisgarh, Odisha and Tamil Nadu. The performance of any crop or variety largely depends upon its genetic makeup and climatic condition of the region under which they are grown. As a result, cultivars which perform well in one region may not perform well in other regions of varying climatic conditions. Hence, it is very much necessary to collect and evaluate all the available genotypes in order to select suitable and high yielding genotypes for a particular region. Considering the potentiality of this crop, it is very much necessary to find out the varieties suitable to a particular region. Yield, quality, vase life and shelf life are the important characters to be considered for the evaluation of genotypes of tuberose.

Tuberose (*Polianthes tuberosa* L.) is one of the most popular bulbous ornamental plants of tropical and subtropical areas in the family Amaryllidaceae, produces attractive, elegant and fragrant white flowers. The flowers having excellent keeping quality and are widely used both as loose flower and cut flower. The flowers remain fresh for quite a long time and stand long distance transportation and find a useful place in the flower market.

It is used as vase decoration, bouquets, making veni, garland, button-holes or crown and frequently the major constraint in tuberose cultivation is weed management and about 70-80 percent of cultivation cost accounts for weeding. Plastic mulching is recommended for weed management, if planted under drip and fertigation system.

Tuberose is commercially grown by marginal and small farmers in western region of Maharashtra. Tuberose flower has a great demand in local market as cut flower and potted plants, previously it was grown with local varieties, but quality is not up to the mark as desired by the customers due to lack of suitable varieties as well as improper use of agro-techniques. Although, there are sufficient number of cultivars under cultivation but their performance is region specific and varies from place to place, information on best

Tuberose cultivar for flower production and cut flower production is lacking under the western region of Maharashtra. Hence, the present investigation was undertaken with emphasis on selection of suitable double type varieties of Tuberose based on performance for western region of Maharashtra particularly in Pune, Nashik, Satara, Ahmednagar districts of Maharashtra.

Materials and Methods

An investigation was carried out to evaluate different tuberose varieties in respect of growth, flowering, yield and quality of flowers at All India Co-ordinated Research Project on Floriculture, Zonal Agricultural Research Station Ganeshkhind Pune-67 (Maharashtra, India) during the year 2018-19, 2019-20 and 2020-21 in randomized block design with nine treatments and three replications comprising of nine varieties of tuberose viz., V₁-Arka Suvasini, V₂-Arka

Vaibhav, V₃-Local Double, V₄-Phule Rajat (GK-T-D-1), V₅-Bidhan Rajani H-19, and V₆-Bidhan Rajani H-24,. The plant material of different varieties of Tuberose was collected from IIHR, Bangalore (Karnataka), and varieties released from AICRP on Floriculture, ZARS, Ganeshkhind, Pune (Maharashtra).

The experimental plot was brought to fine tilth by ploughing, clod crushing and harrowing. At the time of land preparation, well-rotted FYM @ 30 t ha⁻¹ was mixed uniformly in the soil before last harrowing. The field was then laid out with ridge beds of the dimension 1.80 m x 1.50 m. As per the treatment, uniform and healthy bulbs of six varieties of tuberose were planted in the prepared plots at the spacing of 30 cm x 30 cm. fertilizer dose 300:200:300 kg/ha was applied Half dose of N i.e.150 kg nitrogen was applied in the form of urea before planting of bulbs and the remaining half dose of nitrogen was top dressed after 30 days of planting. However, the full dose of 200 kg phosphorus and 300 kg potassium ha⁻¹ was applied in the form of single super phosphate and muriate of potash, respectively at the time of transplanting. Remanning dose of nitrogen was given in three split doses i.e. at 30, 60 and 90 days after planting. All the cultural operations viz., weeding, irrigation, pest control etc. were carried out as and when required. Various observations on growth, flowering, yield and quality parameters viz., Days to spike emergence (days), Days to opening of first floret, Flowering duration (days), Spike length (cm), Rachis length (cm), No of florets/spike, Length of floret (cm), Diameter of floret (cm), Weight of spike(g), Number of petals, Number of whorls, Number of spikes / plant and Vase life (days) of flower were recorded at proper stages and the data was statistically analyzed by the method suggested by Panse and Sukhatme (1969)^[4].

Table 1: Testing of genotypes in Tuberose for cut flower (Pune pooled data 2018-19, 2019-20, 2020-21).

Sr. No.	Variety	Days to spike emergence (days)				Days to opening of first floret				Flowering duration (days)				Spike length (cm)			
		2018-19	2019-20	2020-21	Pooled Mean	2018-19	2019-20	2020-21	Pooled Mean	2018-19	2019-20	2020-21	Pooled Mean	2018-19	2019-20	2020-21	Pooled Mean
1	Arka Suvasini	80.00	80.75	82.00	80.92	95.00	98.75	101.00	98.25	230.00	233.25	236.25	233.17	99.93	99.50	101.54	100.32
2	Arka Vaibhav	63.67	63.50	65.75	64.31	79.33	79.75	82.25	80.44	233.67	231.75	233.00	232.81	86.87	85.59	87.52	86.66
3	Local Double	71.33	75.25	77.25	74.61	87.33	95.75	98.25	93.78	229.67	228.25	228.75	228.89	106.03	104.17	106.06	105.42
4	Phule Rajat (GK-T-D-1)	64.00	65.00	69.75	66.25	81.33	84.00	90.00	85.11	234.00	233.75	233.75	233.83	75.27	77.33	78.83	77.14
5	Bidhan Rajani H-19	77.67	81.00	82.75	80.47	92.67	95.50	96.50	94.89	230.00	227.75	231.00	229.58	63.67	66.17	68.96	66.27
6	Bidhan Rajani H-24	85.33	86.75	87.50	86.53	100.33	103.50	104.75	102.86	235.00	233.25	236.00	234.75	82.47	85.71	86.54	84.91
	SE(m)	1.42	1.38	1.04	0.68	2.03	1.28	1.02	1.05	1.17	1.41	1.23	0.86	3.06	1.59	0.96	0.72
	C.D.at 5%	4.16	4.18	3.17	2.15	5.97	3.88	3.09	3.35	3.43	4.29	3.75	2.74	1.04	4.84	2.91	2.31

Sr. No.	Variety	Rachis length (cm)				No of florets/spike				Length of floret (cm)			
		2018-19	2019-20	2020-21	Pooled Mean	2018-19	2019-20	2020-21	Pooled Mean	2018-19	2019-20	2020-21	Pooled Mean
1	Arka Suvasini	51.40	51.55	52.64	51.86	40.00	42.50	44.00	42.17	5.70	5.75	5.80	5.75
2	Arka Vaibhav	46.77	45.13	45.13	45.68	42.00	41.00	43.00	42.00	6.33	6.20	6.30	6.28
3	Local Double	43.50	44.15	45.09	44.25	40.00	39.00	40.00	39.67	6.60	6.58	6.60	6.59
4	Phule Rajat (GK-T-D-1)	44.53	44.33	44.99	44.62	44.00	44.00	44.25	44.08	6.17	6.23	6.35	6.25
5	Bidhan Rajani H-19	40.17	40.74	41.22	40.71	27.00	31.00	33.00	30.33	4.90	4.65	4.70	4.75
6	Bidhan Rajani H-24	41.03	42.16	43.16	42.12	38.00	39.00	40.25	39.08	5.20	5.15	5.20	5.18
	SE(m)	0.80	0.75	0.66	0.40	1.02	1.16	1.03	0.75	0.16	0.08	0.08	0.04
	C.D.at 5%	2.36	2.27	2.02	1.27	3.00	3.54	3.14	2.38	0.48	0.25	0.24	0.13

Sr. No.	Variety	Diameter of floret (cm)				Weight of spike (g)				Number of petals			
		2018-19	2019-20	2020-21	Pooled Mean	2018-19	2019-20	2020-21	Pooled Mean	2018-19	2019-20	2020-21	Pooled Mean
1	Arka Suvasini	3.33	3.40	3.55	3.43	143.20	141.09	137.58	140.62	23.67	24.20	24.45	24.11
2	Arka Vaibhav	4.23	4.15	4.18	4.19	115.87	111.95	112.94	113.59	14.33	14.78	14.78	14.63
3	Local Double	3.60	3.53	3.58	3.57	160.67	159.35	161.04	160.35	25.33	24.70	24.70	24.91
4	Phule Rajat (GK-T-D-1)	4.13	4.18	4.28	4.20	132.63	131.53	132.20	132.12	23.33	24.03	24.28	23.88
5	Bidhan Rajani H-19	4.23	4.23	4.33	4.26	102.13	104.89	105.85	104.29	22.00	22.24	22.51	22.25
6	Bidhan Rajani H-24	4.37	4.48	4.55	4.47	112.84	113.45	114.14	113.48	24.00	25.46	25.94	25.13
	SE(m)	0.10	0.07	0.06	0.03	1.39	1.34	2.21	1.04	0.83	0.92	0.74	0.26
	C.D.at 5%	0.29	0.21	0.18	0.11	4.07	4.07	6.71	3.33	2.43	2.79	2.24	0.82

Sr. No.	Variety	Number of whorls				Number of spikes / plants				Vase life (days)			
		2018-19	2019-20	2020-21	Pooled Mean	2018-19	2019-20	2020-21	Pooled Mean	2018-19	2019-20	2020-21	Pooled Mean
1	Arka Suvasini	5.53	5.25	5.50	5.43	6.87	6.50	7.00	6.79	7.93	7.25	7.50	7.56
2	Arka Vaibhav	2.70	2.50	2.75	2.65	7.47	6.50	6.50	6.82	6.53	6.00	6.25	6.26
3	Local Double	5.13	5.00	5.25	5.13	8.57	7.00	7.25	7.61	7.07	6.00	6.25	6.44
4	Phule Rajat (GK-T-D-1)	4.10	4.00	4.50	4.20	10.00	8.50	8.75	9.08	8.90	8.25	8.50	8.55
5	Bidhan Rajani H-19	2.80	2.50	2.75	2.68	6.63	7.75	8.50	7.63	6.67	6.50	7.00	6.72
6	Bidhan Rajani H-24	3.00	3.25	3.50	3.25	7.00	8.00	8.25	7.75	7.13	7.50	8.00	7.54
	SE(m)	0.14	1.11	0.25	0.08	0.16	1.34	0.50	0.43	0.46	0.48	0.44	0.19
	C.D.at 5%	0.42	0.37	0.77	0.24	0.46	0.44	1.53	1.38	0.16	1.47	1.32	0.60

Results and Discussion

The present experiment was conducted for three consecutive years (2018-19 to 2020-21) at AICRP on Floriculture Pune centre. The results revealed that among the six double type tuberose genotypes the genotype Local Double recorded significantly more spike length (105.42 cm), length of floret (6.59 cm) and weight of spike (160.35 g). The cv. Suvasini recorded significantly more rachis length (51.86 cm). However, the cv. Phule Rajat recorded more number of florets per spike (44.08) which is at par with cv. Suvasini (42.17) and Vaibhav (42.00). The greater number of spikes (9.08) per plant was recorded by Phule Rajat which is at par with BRH-24 (7.75).

Results and Discussion

Yield parameters

The data pertaining to spike yield and its attributing parameters, rachis length and number of florets per spike are presented in Table 1. The genotypes showed significant difference with respect to number of spikes produced per plant. The range was observed from 6.79 to 9.08 per plant. The genotypes Phule Rajat recorded maximum number of spikes per plant 9.08 which was at par with Bidhan Rajani H-24 (7.75), and followed by genotypes Local Double (7.61) and Bidhan Rajani H-19 (7.63) the least were recorded in the genotype Arka Suvasini (6.79). The Weight of spike (g) was in the range of 104.29 to 160.35. The significantly maximum weight of spike was recorded by Local double (160.35) followed by Arka Suvasini (140.62). The minimum weight of spike was recorded by genotype Bidhan Rajani H-19 (104.29). Increased spike yield has direct relation with number of leaves produced per plants. This in turn will provide more area for photosynthesis, thus there will be a better overall growth of the plants. This will also help in production of more number of spikes per plant and per hectare. Similar results were also reported by Bankar and Mukhopadhyaya (1988) [3], Singh (2004) [18] and Krishan and Misra (2005) [8] in tuberose. The genotypes under study varied significantly with respect to spike length and the range was from 66.27 cm to 105.42 cm. The significantly maximum

spike length was recorded in the genotype Local Double (105.42cm) and was significantly superior over other genotypes. The minimum spike length was observed in the genotype Bhidhan Rajani-19 (66.27 cm). The genotypes showed significant variation in rachis length with range of 40.71 cm to 51.86 cm. The genotype Arka Suvasini produced significantly longest rachis length (51.86 cm), followed by Arka Vaibhav (45.68 cm), whereas the shortest rachis length was recorded by Bhidhan Rajani H-19 (40.71). With respect to number of florets per spike the range was observed from 30.33 to 44.08 per spike. The genotypes Phule Rajat recorded maximum number of florets per spike which was at par with Arka Suvasini (42.17) and Arka Vaibhav (42.00). The significantly least number of florets per spike was recorded bhidhan Rajani H-19 (30.33). The longer spike length might also due to the better vegetative growth of the genotypes. The similar variation for spike length was also reported previously by Patil *et al.*, (1987) [13], Biswas *et al.*, (2002) [4], Singh (2004) [18] and Patil *et al.*, (2009) [14] in tuberose. The increased rachis length was due to more internodal distance in between the pair of florets. The similar variations for rachis length was also reported previously by Singh (2004) [18] and Krishan and Misra (2005) [8] in tuberose. The data pertaining to loose flower yield and bulb yield presented in Table 2. The more production of flowers has direct relation with better vegetative growth of the plants, which leads to the production of more number of spikes per plant as well as more number of florets per spike; in turn it results in increased loose flower yield per plant, per plot and per hectare. Similar variation in loose flower yield was also reported previously by Irulappan *et al.*, (1980) [6], Patil *et al.*, (1987) [13], Meenakshi and Niranjan Murthy (1997) [10] and Gupta *et al.*, (2004) [5] in tuberose. Genotype with more number of leaves has improved photosynthetic activity, source and sink relationship and accumulates more carbohydrates which improve the bulb and bulblet yield per plant, per plot and per hectare. Similar variation in bulb yield was also reported previously by Krishnamoorthy (2014) [9] and Singh and Singh (2013) [19] in tuberose.

Flower quality parameters

The data pertaining to flower quality parameters like Flower diameter, vase life in different genotypes of tuberose is represented in Table 3. Flower diameter differed significantly among the genotypes. The significantly maximum diameter of floret was recorded by Bhidhan Rajani -24 (4.47cm), whereas minimum diameter was recorded in genotype Arka Suvasini (3.55 cm).

The genotypes showed significant difference with respect to number of petals per floret. The range observed was between (14.63 to 25.13). The genotype Bidhan Rajani recorded maximum number of petals (25.13) which is at par with Local Double (24.91) and was followed by genotype Arka Suvasini (24.11). The significantly minimum number of petals was recorded in genotype Arka Vaibhav (14.63).

The genotypes showed significant difference with respect to number of whorls per floret. The range observed was between (2.65 to 5.43). The genotype Arka Suvasini recorded significantly maximum number of whorls (5.43). The minimum number of whorls was recorded in genotype Arka Vaibhav (2.65), which is at par with Bidhan Rajani-H-19 (2.68).

Phule Rajat recorded significantly maximum vase life (8.55 days) followed by genotype Arka Suvasini (7.56 days). The minimum days for vase life was observed in genotype Arka Vaibhav (6.26) followed by Bidhan Rajani H-19 (6.72) days.

Flower quality related traits like flower diameter, number petals, number of whorls, number of spikes per plant and vase life play a key role in deciding the quality of flowers and adoption of genotypes for cultivation. In present investigation genotype Phule Rajat followed by Bidhan Rajani H-24 and Arka Suvasini recorded maximum flowers. Variation in flower size due to genotypic variation is attributed to their genetic makeup. The results have been reported earlier by Nandakishore and Raghava (2001)^[11] in marigold.

The highest weight of spike was recorded in Local Double (160.35) followed by Arka Suvasini (140.62) and Phule Rajat (132.12). The variation among the genotypes was mainly due to flower size. Similar results were also reported previously by Biswas *et al.*, (2002)^[4] and Sateesha (2004)^[16] in tuberose. Variation among the genotypes for vase life is due to interaction effect of spike length and harvest stage. The increase or decrease in stalk length may be attributed to their variation in reserved food material. The similar findings have been reported earlier by Sateesha *et al.*, (2011)^[17] and Varu and Barad (2010)^[20] in tuberose. The variation in vase life might be attributed loss of weight of flowers and genetic inherent character of varieties as they have been reported earlier by Nandakishore and Raghava (2001)^[11] in marigold.

Conclusion

The tuberose variety Phule Rajat followed by Bidhan Rajani H-24 and Arka Suvasini were found promising for higher quantitative and qualitative flower yield under Pune condition.

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