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Research Article

EVALUATION OF TUBEROSE GENOTYPES FOR VEGETATIVE, FLORAL AND BULB YIELDING ATTRIBUTES UNDER THE VALLEY CONDITIONS OF GARHWAL HIMALAYAS

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Abstract- Investigation on evaluation of nine genotypes of Tuberose (*Polianthes tuberosa*) with respect to growth and flowering parameters were carried out under valley conditions at HNBGU, Srinagar Garhwal, Department of Horticulture, during 2013-14. The genotypes were studied for various vegetative, floral and bulb yielding attributes. Results revealed that there was a significant variation among the genotypes for various attributes. Out of the nine genotypes studied, Genotype Subasini (G9) recorded to have maximum plant height (56.00 cm), leaf area (51.71cm^2), maximum number of sprouts (9.26) per plant, fresh weight of spike (123.47 g) and highest yield of spike (1.11 kg) per plot, vase life (14.22 days) and regarding bulb yielding attributes genotype G5 (Vaibhav) have maximum bulb diameter (1.77 cm) and bulb length (4.78 cm) Keeping all these parameters in view, it may be concluded that genotype Subasini is suitable for cultivation in the valley conditions of Garhwal region followed by Vaibhav and Kalyan Single.

Keywords- Tuberose, Germplasm, Evaluation, Bulb and yield attributes.

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Introduction

Flower cultivation is a lucrative profession having higher potential for returns than most of the field and other horticultural crops. Demand for flowers is increasing at a faster rate owing to the liberalization of economy and globalization of trade. The leading flowers which are in great demand are rose, chrysanthemum, carnation, gladiolus, tuberose, anthurium and marigold. Tuberose is gaining popularity due to higher returns per unit area and their beautiful and attractive long lasting spikes. Tuberose (*Polianthes tuberosa* L.), a member of family Amaryllidaceae, is an ornamental bulbous plant that originated in Mexico. It can be used both as a cut flower and loose flower. It is mainly grown in the tropical and subtropical areas for cut flower and fragrance [1]. But the performance of tuberose genotypes varies with the prevailing season and growing environment. In India there is a wide difference in temperature, light intensity and humidity which not only affects the quality and yield of the flowers but also limits their availability for a particular period. Therefore, evaluation of genotype becomes a prime consideration before suggesting it for a particular region. Hence, this study was conducted to assess suitable varieties for valley conditions of Garhwal Himalayas.

Materials and Methods

The investigation was carried out at the Department of Horticulture, HNBGU, Srinagar Garhwal during 2013-14 to evaluate the performance of different genotypes of Tuberose. The location is situated in Alaknanda valley which lies between 78^{0}47'59.1" E longitude and 30^{0}13'25.1" N latitude, right in the heart of Garhwal region at an average elevation 551 m above MSL, in the lesser Himalayan region. The experimental material consists of nine genotypes of Tuberose including Double, Hyderabad Double, Swarnarekha, Prajwal, Vaibhav, Shringar, Sikkim Selection Kalyan Singleand Subasini. The experiment was laid out in Randomized Complete Block Design (RCBD)and replicated thrice. The experimental field was deeply ploughed and large clods were pulverized to get fine tilth. Weeds, stone chips etc were thoroughly cleaned out and the field was properly leveled. A spacing of 45 cm between replications and 30 cm between two plots were provided for laying out of irrigation channels and bunds respectively. The entire experimental land was divided into plots measuring 1m × 1m and there were totally 27 plots, each plot was separated from each other by 10 cm wide ridge. All the standard cultural practices were followed for raising the crop. The data from all the genotypes were recorded randomly in each replication for various vegetative, floral and bulb characters. All the data collected was statistically analyzed as per the methods of [2].

Results and Discussion

Vegetative Parameters

The mean performance of the genotypes under study for vegetative parameters reflected a significant variation among them. Genotype Hyderabad Double (G2) took minimum (34.26) days for sprouting, whereas, genotype Prajwal (G4) took maximum days (58.11) for sprouting after planting.

Plant growth which is considered to be a good index of plant vigour also contributes towards greater productivity. Among the various genotypes, plant height was found to be maximum (56.00 cm) in Suvasini, i.e. G9 and it was found to be statistically at par with all the varieties under study. And minimum plant height (36.89 cm) was recorded in G8 (Kalyan Single).

It is clear from the data presented in [Table-1] that number of leaves per plant was not significantly influenced by different genotypes. Maximum number of leaves (28.78) was recorded in the variety G6 (Shringar), and minimum (20.11) number of leaves was observed in the variety G8, i.e., Kalyan Single.

Significant differences were observed among various genotypes with respect to

leaf area (cm^2) in Tuberose [Table-1]. Genotype G9 (Subasini), recorded to have maximum leaf area (51.71cm^2), and it was found to be statistically at par with the variety G4 and G8 (49.71 and 46.90 cm^2), whereas, the minimum leaf area (30.55 cm^2) was recorded in G7 i.e., Sikkim Selection.

Table-1 *Performance of different tuberose genotypes for various vegetative attributes under valley conditions*

Genotypes	No. of days required to sprouting	Plant height (cm)	Number of leaves / Plant	Leaf area (cm^2)	Flowering duration (Days)
G1	37.40	48.89	24.89	35.09	35.67
G2	34.26	52.33	25.00	36.82	0.00
G3	35.56	49.33	23.78	31.95	0.00
G4	58.11	54.56	27.00	49.71	22.67
G5	47.47	49.78	25.22	44.40	22.55
G6	50.00	49.45	28.78	42.40	20.83
G7	41.04	52.11	24.78	30.55	20.63
G8	38.96	36.89	20.11	46.90	22.00
G9	36.67	56.00	25.22	51.71	32.56
Sem ±	1.36	3.19	3.22	1.97	3.75
CD at 5%	4.09	9.57	Ns	5.91	11.25

Variation among the genotypes for sprouting might be due to maximum reserve carbohydrate in bulb and bulb size responsible for early sprouting. And due to genetic characters and congenial climatic conditions. This is in accordance with the findings of Lekha Rani [3] in Dendrobium orchids, Ninitha Nath [4] in Monopodial orchids, Ede [5] in Vanda and Wang and Lee [6] in Phalaenopsis.

The vegetative character, *viz*; plant height, number of leaves, leaf area and days required to sprouting determines the overall quality and productivity of Tuberose. The variation in plant height can be attributed to genetic constitution. This is in line with the findings of Singh *et al.*, [7]. The variation in leaf production is among the varieties can be attributed to genetic character. Even the environmental factors i.e. temperature, relative humidity and light intensity also determine the production of leaves. This result is closer to the findings as reported by Tewari [8] and Sadhu *et al.,* [9] in tuberose.

Floral Parameters

Floral parameters are important parameters in judging the overall quality and acceptability of flowers to the consumers. It is vivid from the data presented in [Table-2] that number of days taken to spike emergence of plant was significantly influenced by different genotypes. Maximum days (283.50) for spike emergence was recorded in G3, i.e. Genotype Swarnarekha, while the genotype, G8 (Kalyan Single) took minimum number of days (174.11) for spike emergence.

Length of spike is an important parameter as it judges its use as a quality cut flower. The maximum length (117.56 cm) of spike was observed in the variety G7 (Sikkim Selection), while the minimum (20.00 cm) length of spike was observed under the variety G3, i.e., Swarnarekha [Table-2]. However, the data regarding spike length were not affected significantly by varieties.

Data presented in [Table-2] indicates that the fresh weight of spike was significantly affected by various varieties. The highest (123.47 g) fresh weight of spike was observed with G9 i.e. Subashini genotype. However, the minimum fresh weight (32.17 g) was recorded with Kalyan Single.

Flowering duration is an important parameter as it judges the availability of flower in the market. Among the various genotypes evaluated the duration of flowering was significantly affected. Genotype G1 had maximum (35.67) duration of flowering, followed by G9 (32.56) whereas, genotype G7 had minimum duration (20.63) of flowering.

Number of florets/flower spike is of important consideration when it is to be used as loose flower and also it determines the floriferousness. Significant variation was observed among various genotypes with respect to number of floret/flower spike of plant. Maximum number of florets was recorded in genotype G1 (52.33) closely followed by G8 (52.22), G4 (49.11), G9 (48.45), G6 (46.22) and G5(38.89), whereas, minimum (31.33) number of florets was recorded in genotype G7.

Data presented in [Table-2] indicated that the yield of flower spike/plot weight was significantly affected by various varieties. The highest (1.11 kg) total yield of flower spike per plot weight observed with G9, i.e. Subashini variety. However the minimum yield (0.28 kg) was recorded in Kalyan Single, i.e. G8.

Vase life has greater value in determining the marketing of flowers to the distant market. The number of days to vase life flowers was significantly affected different varieties [Table-2] and [Table-3] were observed among various variety with respect to number of days to vase life flowers of plant required to highest value G9 (14.22) followed by G1 (13.44), G6 (12.22), G7 (11.56), G4 (10.89) and G8 (10.44) minimum G5 (7.69).

The differences in flower characters of various genotypes is might be due to favorable climatic conditions like temperature (23.22-27.33°C) and high relative humidity (9.2-96 %) and long day sunshine hours (8.11-8.61) in April-May bulb planting in the experimental area which induced better vegetative growth followed by induction of early flowering, improved florets number per spike, floret length and spike length while unfavorable climatic conditions *viz*., low temperature delayed flowering, reduced florets number per spike, floret length, spike length and vase life in December-January. These results are in accordance with the findings of Dubey *et. al.* [10] and Roy [11] who reported similar pattern of flower growth in tuberose. Difference in number of flower spikes / plant among the various genotypes is might be due to the genetic variation. Similar results were reported by Ranchana *et al.,* [12] Tuberose. The increased flower / spike yield might also be attributed to the greater leaf area, more number of pseudo bulbs per plant as well as more number of leaves per plant and these would have resulted in production and accumulation of maximum photosynthetic activity which ultimately results in production of more number of spikes with bigger sized flowers. The results are in accordance with the findings of Barman *et al*. [13] in Cymbidium, Soocheon *et al*. [14] in Dendrobium orchids, Fadelah [15] in Dendrobium orchids and Thomas and Lekha rani [16] in Monopodial orchids. The variation in vase life of tuberose flowers must be due to the differences insenescencing behavior of the cultivars by producing higher amount of ethylene forming enzymes. This fact was also in agreement with Kandpal *et al.* [17] in Gerbera and Punetha *et al*., [18] in Chrysanthemum.

Table-2 *Performance of different tuberose genotypes for various flowering attributes under valley conditions*

Genotypes	Number of days taken to spike emergence	Spike length (cm)	Number of floret/flower spike	Fresh weight of Spike	Flowering duration	Yield of flower spike/plot (kg)	Vase life (days)
G1	269.50	82.83	52.33	121.04	35.67	1.06	13.44
G2	270.17	27.66	0.00	0.00	0.00	0.00	0.00
G3	283.50	20.00	0.00	0.00	0.00	0.00	0.00
G4	262.55	82.56	49.11	54.72	22.67	0.49	10.89
G5	251.11	81.89	38.89	51.44	22.55	0.68	7.67
G6	216.00	67.89	46.22	36.87	20.83	0.31	12.22
G7	185.33	117.56	31.33	34.03	20.63	0.29	11.56
G8	174.11	71.33	52.22	32.17	22.00	0.28	10.44
G9	230.33	85.22	48.44	123.47	32.56	1.11	14.22
Sem±	11.17	9.21	6.48	8.81	3.75	0.02	1.36
CD at 5%	33.51	27.62	19.44	26.41	11.25	0.06	4.09

Bulb Parameters

Tuberose is propagated commercially by bulbs and bulb size also influences flowering in it. During the course of investigation bulb diameter was found to be statistically significant [Table-3]. Bulb diameter was maximum in genotype G5 (1.77) and was statistically at par with all genotypes except G3 and G7 and G7, i.e Genotype Sikkim Selection recorded to have minimum (1.30) bulb diameter.

Similarly different genotypes showed significant variation for the bulb length [Table-3] Maximum (4.78 cm) length of bulb was attained in Genotype Vaibhav (G5) followed by G8 (4.74 cm), G4 (4.68 cm), G2 (4.61 cm), G1 (4.48 cm), G3 (4.23 cm) and G6 (4.06 cm) and minimum (3.87 cm) diameter in G9, i.e. Genotype Subasini.

Table-3 *Performance of different tuberose genotypes for various bulb parameters under valley conditions*

Varieties	Bulb diameter (cm)	Bulb length (cm)	Number of bulblets/bulb	Total yield of bulb/plot (kg)
G1	1.52	4.48	27.33	2.20
G2	1.55	4.61	28.33	2.06
G3	1.36	4.23	21.67	0.98
G4	1.75	4.68	22.67	2.31
G5	1.77	4.78	28.67	2.05
G6	1.71	4.06	21.67	2.21
G7	1.30	3.81	24.00	1.76
G8	1.56	4.74	17.00	1.91
G9	1.64	3.87	24.67	1.96
Sem ±	0.09	0.22	3.44	0.32
CD at 5%	0.28	0.68	Ns	0.97

Number of bulbets per bulb was not significantly influenced by different genotypes [Table-3] and maximum number of bulbets (28.67) was observed in the genotype G5 (Vaibhav), whereas, minimum (17.00) number of bulblets/bulb was produced in the genotype G8, i.e., Kalyan Single. The total yield of bulb per plot was not significantly influenced by different genotypes [Table-3] The maximum total yield of bulb per plot (2.31 kg) was observed in the variety G4 (Prajwal), while, the minimum (0.98 kg) total yield of bulb per plot was observed under the variety G3, i.e., Swarnarekha. Formation and development of bulbs are directly related with NPK fertilizer and depends upon promotion of cell proliferation and storage of starch in the resulting cells. Cell division and cell enlargement are accelerated by ample supply of nitrogen, which initiates meristematic activity. This finding was supported by Crowther [19] in bulbous crops.

Conclusion

Thus from the present investigation it can be concluded that genotype Subasini followed by genotypes Kalyan Single and Vaibhav are suitable for cultivation under the valley conditions of Garhwal Himalayas, for getting handsome returns to the farmers.

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