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Performance of tuberose (*Agave amica*) genotypes for cut flower production under North Bihar agro-climatic conditions

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Abstract

The performance of varieties of any crop differs from one region to another region. Hence, selection of genotype is an important criterion for successful cultivation of any crop. Traditionally in double tuberose very few traditional varieties are present thus the new genotype when compared with older checks paves way for adoption of better performing genotype in a certain area. Different growth parameters of three new tuberose genotypes were compared with two traditional genotypes for use as cut flower purpose under north Bihar agro-climatic conditions at the Research farm of Dr Rajendra Prasad central Agricultural University, Bihar, Pusa, Samastipur from 2020-22. The double genotype, 'Bidhan Rajani H-24' was found to be the most suitable genotype for the region when compared with all others under study. This genotype was found significantly superior than all the other genotypes with respect to days to opening of first florets, flowering duration, spike length, rachis length, number of spikes per clump, and cost benefit ratio. The double variety 'Phule Rajat' was found to be at par with double genotype 'Bidhan Rajani H-24' for traits like, days to spike emergence, number of floret per spike, length of florets, loose flower yield, number of bulb per clump and lowest reaction to rot knot nematode. The check double variety 'Subhashini' only showed superiority in highest weight of 100 florets.

Keywords: Tuberose, double types, cut flowers, bulbs

Introduction

The beauty of flowers is associated since the origin and advancement of the human civilization at the planet. Tuberose (*Agave amica*), is a herbaceous perennial plant, native of Mexico and belongs to the family Asparagaceae is an important, popular flower crop being cultivated on a large scale for its scented flower in many parts of the world and in plains of India. Among the ornamental bulbous plants valued for their beauty and fragrance of the flowers, the tuberose occupies a very selective and special position. Among the cultivated flowers, the tuberose (*Agave amica*) or Rajanigandha has gained considerable importance in flower growing community of Bihar owing to its pleasant fragrant flowering spikes, longer vase life, flowering in mid-summer when no other cultivated flower crop does well in hot climate of Bihar. The aromatic oils extracted from its fragrant white flowers are also one of the valuable products of this flower. The 'Single type' flowers are more fragrant to 'Double type' and the flowers of single types are mainly used for extraction of aromatic oils, loose flowers as well as cut flowers and for making garlands and bouquets while the double typed flowers are used for only cut flowers, garden display and interior decoration (Krishnamoorthy, 2017) ^[1]. The commercial cultivation of tuberose is mainly concentrated to tropical and subtropical regions of the world like, India, Kenya, Mexico, Morocco, France, Italy, Hawaii, South Africa, Taiwan, North Carolina, USA, Egypt and the China. In India it is largely cultivated in West Bengal, Gujarat,

Maharashtra, Andhra Pradesh, Tamil Nadu, Karnataka, Punjab, Assam, Uttar Pradesh and Bihar (Rachana *et al*, 2013) ^[2]. There are several cultivars and local varieties of tuberose are available and being developed in India and abroad thus these genotypes need to be evaluated for location specific adaptability and its performance. The study will promote the growers to find the most suitable and high yielding genotype for their region. The critical assessment of genotypes will also help the breeders for further advancement in floral and yield characters through breeding programmes. Hence, the present investigation was conducted to study the relative performance of the five new genotypes. In India cultivation of cut and loose flower crops covered around 323 thousand hectare, with an average production of 3000 thousand MT

and average productivity was 9.29 MT / ha. (Anon., 2019 - 20) [3]. There is heavy demand of flowers during marriage ceremonies, festivals and other social function. There is a large gap between supply and demand which the local growers which may utilize their advantage. Tuberose is one of the dominating flowers in the flower market of Bihar and the State is blessed with many natural advantages like abundant sunshine and favorable temperatures for its growth. The location specific assessment of tuberose genotypes will provide opportunities for improvement of quality traits of flower for breeding programmes to improve the yield and quality of the flowers. The present investigation was undertaken to assess the seven tuberose genotypes and the variability present among them. In the context of agro climatic situation of North Bihar, the available information's are very scanty and not enough on these aspects. Keeping in view the above facts, the present study was undertaken to evaluate the growth performance of different tuberose cultivars and to identify the best cultivar having good growth, flowering attributes and vase life under humid agro climatic conditions of North Bihar.

Materials and Methods

The experiment was conducted at research farm, Hi-tech Horticulture of RPCAU, Pusa in Randomized Block Design during the years 2020, 2021 and 2022. The experimental site was located at 25.98° N and 85.67° E with an altitude of 52.0 m above mean sea level. The climate of experimental site is sub-tropical characterized with moderate precipitation, hot and dry summer and cold winter with maximum yearly rainfall (about 90%) received due to south - west monsoon during June to October and the months of December to February receiving occasional and light winter showers. April, May and June are the hottest months while December and January are the coldest. The temperature varies between 6°C to 45°C with maximum in May - June and minimum in December - January while the RH ranged from 60 per cent to 93 per cent. Five tuberose genotypes (Bidhan Rajani H 19, Bidhan Rajani H 24, Phule Rajat, Suvasini (check) and Kolkata double (Check) were evaluated for vegetative growth and flowering and yield in a randomized block design with four replications. Twenty plants per treatment were planted at a spacing of 30 x 30 cm. The observations were taken from five randomly selected plants for recording various vegetative, floral characters and bulb / bulblets characters viz., days to spike emergence, days to opening of florets, flowering duration, spike length (cm), Rachis length (cm), number of florets per spike, length of florets (cm), floret diameter (cm), weight of 100 florets (g) number of spikes per clump number of spikes per hectare, loose flower (q/ha), number of bulbs per clump, number of bulblets per and finally the cost benefit ratio was worked out to evaluate these genotypes economically.

Results and Discussion

The research findings of the three year experimentation (2020, 2021 and 2022) on the evaluation of five tuberose double genotypes revealed that the vegetative and floral characters of the plants are greatly influenced due to its genotypes. The tuberose double genotype, Bidhan Rajani H-24 is proved to be the most suitable genotype for agro climatic situation of North Bihar having a lot of vegetative and floral qualities requisite for a quality cut flower and

garden display i.e. lowest days to spike emergence (97.30), lowest days to opening of first florets (111.03), maximum flowering duration (25.77 days), spike length (65.07 cm), Rachis length (51.70 cm), number of florets per spike (43.62), length of florets (5.75 cm), florets diameter (4.73 cm), weight of 100 florets (187.68 g), number of spike per clump (4.68), number of spikes per hectare (3.02 lakh), loose flower per hectare (24.72 t), number of bulb (12.10) and the number of bulblets per clump (16.00) followed by the tuberose double genotype, Phule Rajat with days to spike emergence (102.83), days to opening of first florets (118), flowering duration (22.73 days), spike length (59.80 cm), Rachis length (45.75 cm), number of florets per spike (39.53), length of florets (5.49 cm), florets diameter (4.43 cm), weight of 100 florets (197.10 g), number of spike per clump (4.07), number of spikes per hectare (2.62 lakh), loose flower per hectare (21.37 t), number of bulb (10.07) and bulblets per clump (12.43). The other double genotype, Bidhan Rajani H-19 had recorded days to spike emergence (104.17), days to opening of first florets (119.30), flowering duration (21.83 days), spike length (52.27 cm), Rachis length (36.17 cm), number of florets per spike (33.87), length of florets (5.20 cm), florets diameter (4.42 cm), weight of 100 florets (200.83 g), number of spike per clump (3.77), number of spike per hectare (2.42 lakh), loose flower per hectare (16.68 t), number of bulb per clump (8.07) and the number of bulblets per clump (9.90) (Table -1 & 2). The local check tuberose double genotypes, Subhasini and Kolkata had the significantly inferior floral and vegetative qualities as compared to above mentioned genotypes recording days to spike emergence (112.50 & 107.90), days to opening of first florets (126.20 & 120.70), flowering duration (18.40 & 21.40 days), spike length (47.37 & 52.07 cm), Rachis length (34.90 & 35.36 cm), number of florets per spike (29.53 & 33.50), length of florets (5.03 & 5.10 cm), florets diameter (4.13 & 4.33 cm), weight of 100 florets (233.53 & 205.20 g), number of spikes per clump (3.05 & 3.22), number of spikes per hectare (2.01 & 2.02 lakh), loose flower per hectare (13.21 & 13.73 t) and the number of bulb (7.40 & 7.90) and bulblets per clump (8.68 & 9.77), respectively (Table-1 & 2). Besides the floral qualities the tuberose double genotypes, Bidhan Rajani H-24 and Phule Rajat have also proved to be the economically highly profitable having maximum Benefit cost ratio (B: C ratio) 3.25 and 3.00, respectively as compared to local check genotypes having benefit cost ratios from 1.58 and 2.21 (Table-1 & 2).

The present findings are almost in close conformity with the reports of earlier workers at different agro climatic locations (Krishnamoorthy, 2014; Rachana *et al.* 2013; Martolia., 2010; Patil *et al.*, 2009; Prashanta *et al.*, 2016; Biswas *et al.*, 2002 and Singh and Singh, 2013) [1, 2, 4, 5, 6, 7, 8]. The variation in spike numbers and spike length, rachis length, number of florets and its length and diameter might be due to the inherent genetic make up of different varieties under the influence of agro climatic conditions of the region and these variations have also been observed by Rachana *et al.* (2013), Patil *et al.* (2009) and Prashanta *et al.* (2016) [1, 5, 6]. Almost similar observations were recorded by Biswas *et al.*, (2002) [7] and Singh and Singh (2013) [8] and they observed that the variations in these characters are the result of interaction of genotype with climatic conditions of the particular area. Krishnamoorthy (2014) [1] and Singh *et al.*, (2013) [9] explained that the genotype with more number of leaves might improved photosynthetic activity, that accumulates

more carbohydrates which improve the bulb and bulblets yield per plant, per plot and per hectare however these

characters are much influenced by some other factors like, season, environment etc.

Table 1: Performance of Tuberose double genotypes on floral parameters during 2020, 2021 and 2022 (Pooled)

Sl. no	Treatments (Genotypes)	Days to spike emergence	Days to opening of first florets	Flowering duration (Days)	Spike length (cm)	Rachis length (cm)	No. of florets / spike	Length of florets (cm)	Diameter of florets (cm)
1	Bidhan Rajani H-19	104.17	119.30	21.83	52.27	36.17	33.87	5.20	4.42
2	Bidhan Rajani H-24	97.30	111.03	25.77	65.07	51.70	43.62	5.75	4.73
3	Phule Rajat	102.83	118.00	22.73	59.80	45.75	39.53	5.49	4.43
4	Subhasini (Check)	112.50	126.20	18.40	47.37	34.90	29.53	5.03	4.13
5	Kolkata double (Check)	107.90	120.70	21.40	52.07	35.36	33.50	5.10	4.33
CD at 0.05		6.97	4.06	2.65	4.31	3.49	5.71	0.32	0.25
CV %		6.58	7.59	6.41	6.14	7.55	7.82	6.27	5.12

Table 2: Performance of Tuberose double genotypes on floral yield and bulb / bulb lets parameters during 2020, 2021 and 2022 (Pooled)

Sl. No.	Treatments (Genotypes)	Weight of 100 florets (g)	No. of spike/clump	No. of spike / ha (lakh)	Loose flower (t/ha/year)	No. of bulb/clump	No. of bulb let/ clump	B : C ratio	Reaction to root knot nematode & disease (%)
1	Bidhan Rajani H-19	200.83	3.77	2.42	16.68	8.07	9.90	2.75	4.97
2	Bidhan Rajani H-24	187.68	4.68	3.02	24.72	12.10	16.00	3.25	3.67
3	Phule Rajat	197.10	4.07	2.62	21.37	10.07	12.43	3.00	2.33
4	Subhasini (Check)	233.53	3.05	2.01	13.21	7.40	8.68	1.58	7.83
5	Kolkata double (Check)	205.20	3.22	2.02	13.73	7.90	9.77	2.21	3.17
CD at 0.05		9.33	0.31	0.23	3.95	2.22	1.79	-	-
CV %		5.93	6.47	6.23	11.70	11.96	9.79	-	-

Conclusion

The research findings on the basis three years experimentation and pooled data (2020, 2021 and 2022) reveal that the different genotypes show diverse character in the different vegetative and floral parameters. Among the evaluated five genotypes including two local checks, the tuberose double genotypes, Bidhan Rajani H-24 can be adopted by farmers of North Bihar as cut flower owing to their longest flowering duration, spike and rachis length, lesser days taken to spike emergence. The double genotype Phule Rajat and Bidhan Rajani H-19 are suitable for cultivation for loose flower and cut flower due to their floral quality over others genotypes under the agro climatic situations of North Bihar. It is obvious from the study that both the genotypes have very good economic potential and it would provide maximum net return to the growers/farmers of the State.

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