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Morphological characterization of single type tuberose (*Agave amica* L.)

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Abstract

An investigation on 'Morphological characterization of single type tuberose (*Agave amica* L.)' was carried out at All India Co-ordinated Research Project, Zonal Agricultural Research Station Ganeshkhind Pune (Maharashtra, India) during year 2024-25 in randomized block design with twelve treatments and three replications. The results revealed that among the twelve single type tuberose genotypes studied the genotype GK-T-S-1 found superior over rest of the 1genotypes for various characters namely days required for sprouting of bulbs (9.86 days), plant height (133.16 cm), number of bulbs per clump per year (12.40), spike length (128.16 cm), rachis length (38.40 cm), interval between two spike emergence (21.33 days), vase life (8.37 days), number of spikes per clump per year (11.46). The cv. Arka Prajwal recorded significantly maximum leaf length (61.31 cm), length of floret (7.40 cm), diameter of floret (5.13 cm), weight of 20 florets (36.67 g). The cv. Sahyadri Vaman recorded significantly minimum days to open first floret from spike emergence (11.60 days), inter-floret length (3.95 cm), longevity of spike (25.16 days). Finally, it was concluded that among the different genotypes of single type tuberose under study, genotype GK-T-S-1 was found superior for commercial cultivation.

Keywords: Single, tuberose, floret

Introduction

Tuberose belongs to family Asparagaceae, subfamily Agavoideae and its botanical name is *Agave amica* L. It is one of the most important commercial bulbous flowering crop. The term 'Tuberose' originated from the Greek word 'polios' meaning 'white' or 'anthos' meaning 'flower'. It is commonly known as Nishigandha in Marathi, Rajanigandha in Bengali, Nela sanpengi in Telugu, Sugandharaja in Kannada, Gulchari and Galshabo in Hindi (Jawaharlal *et al.*, 2006) ^[1]. Tuberose is diploid flowering crop with chromosome number 2n=30 (Whitaker, 1934) ^[2]. It has three types of cultivars viz. single, double and semi-double according to number of petal rows (Kameswari *et al.*, 2014) ^[3, 11]. Tuberose is a half-hardy, bulbous perennial plant and it propagated by bulb and bulblets.

Tuberose is native to Mexico (Trueblood 1973) ^[4]. During 16th century it was spread to different parts of the world. In India it occupies the prime position among commercial ornamental bulbous crops. It is mostly cultivated in West Bengal, Tamil Nadu, Karnataka, Andhra Pradesh, Chattisgarh, Odisha, Assam, Telangana and Haryana. India produces 107,910 MT of loose tuberose flowers and 89,290 MT of cut flowers from 16,190 hectares of tuberose.

For a variety of purposes, tuberose can be cultivated effectively as a pot plant and bedding plant. It is used commercially to make garland, for birthday ceremonies, and for floral arrangements including potpouri, bouquets, rangoli, and boutonnières. There is wide diversity in tuberose, hence it was necessary to characterize and identify suitable germplasm for genetic commercial cultivation and further breeding purposes. Hence the present study was undertaken on morphological study of single type tuberose.

Materials and Methods

The experiment was conducted during the year 2024-2025 at the at All India Co-ordinated Research Project on Floriculture, Zonal Agricultural Research Station, Ganeshkhind Pune-67 (Maharashtra, India) to study the various vegetative, flowering and yield parameters of single type genotypes of tuberose. The twelve genotypes used for study were GK-T-S-1, GK-T-S-2, GK-T-S-4, GK-T-E-2, GK-T-C-2, GK-T-C-4, Local Single, Varigated, Sahyadri Vaman, Phule Rajani, Pratap Rajani and Arka Prajwal.

Pune is situated in mid-west Maharashtra at an altitude of 569 meters above mean sea level. It comes in tropical region 18°-32' North latitude and 73°-51' East Longitude. The soil of experimental area was medium black with good drainage. The number of bulbs planted were 32 per treatment. The bulbs of selected varieties were planted in the field on raised beds at a spacing of 30 cm × 30 cm in the first week of July 2024. All cultural practices (weeding, hoeing and irrigation) was followed in the field to produce good quality flowers. The data on various vegetative growth, flowering and yield parameters were recorded as per DUS guidelines on days required for sprouting of bulbs, plant height at spike harvesting stage (cm), horizontal spread of plant at spike harvesting stage (cm), leaf length at spike harvesting stage (cm), leaf thickness at spike harvesting stage (mm), number of bulbs per plant per year, number of bulblets per plant per year, days to emerge first spike from plantation, days to open the first floret from spike emergence, spike length at spike harvesting stage (cm), spike thickness at spike harvesting stage (mm), rachis length at spike harvesting stage (cm), inter-floret length between first two pairs of florets at spike harvesting stage (cm), length of floret (cm), diameter of floret (cm), longevity of spike (days), interval between two spikes emergence (days), vase life (days), weight of 20 florets, number of spikes per clump per year, number of florets per spike. The study was conducted using Randomized Block Design (RBD) with three replications.

Results and discussion

The results on various vegetative, flowering and yield parameters are presented as below:

Vegetative Growth Parameters

The data presented in table 1 revealed that, the days required for sprouting of bulb was in the range between 9.86 to 15.36 days with overall mean 12.09 days. The significantly early sprouting was observed in genotype GK-T-S-1 (9.86 days) followed by genotype GK-T-C-2 (10.05 days) and cv. Pratap Rajani (10.53 days). However, the significantly late sprouting was observed in cv. Sahydari Vaman (15.36 days) followed by cv. Varigated (14.40 days) and genotype GK-T-S-4 (13.77 days). These results are in the same line of Naik *et al.* (2018) ^[15], in tuberose.

The maximum plant height was observed in cultivar genotype GK-T-S-1 (133.16 cm) which was at par with cv. Local single (129.4 cm). However, the significantly minimum plant height was observed in cultivar cv. Sahydari Vaman (45.29 cm) followed by genotype GK-T-E-2 (51.87 cm) and genotype GK-T-S-2 (65.09 cm). Similar results were reported by Naik *et al.* (2018) ^[15] and Dimri *et al.* (2017) ^[9] in tuberose. A significant difference was observed for horizontal spread of plant at harvesting stage among the different genotypes. The maximum horizontal spread of plant at harvesting stage was observed in genotype GK-T-S-1 (74.90 cm) which was at par with cv. Arka Prajwal (72.19 cm) and cv. Varigated (70.62cm). The minimum horizontal spread of plant at harvesting stage was recorded by genotype GK-T-E-2 (41.99 cm) which was at par with genotype GK-T-S-2 (44.86 cm). The similar findings were recorded by Patil *et al.* (2009) ^[16], Dimri *et al.* (2017) ^[9] in tuberose.

The maximum leaf length was observed in cv. Arka Prajwal (61.31cm) which was at par with genotype GK-T-C-2 (58.41cm) and cv. Varigated (57.94cm). While the significantly minimum leaf length was observed in genotype

GK-T-E-2 (29.67cm) followed by cv. Sahydari Vaman (42.11 cm) and GK-T-S-4 (44.57 cm). 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. Such result were also recorded by Rao and Janakiram (2006) ^[19] in tuberose. The maximum leaf thickness at harvesting stage was observed in genotype GK-T-C-4 (1.02 mm) which was at par with cv. Sahydari Vaman (1.01 mm), genotype GK-T-E-2 (0.95 mm) and genotype GK-T-S-4 (0.94 mm). The minimum leaf thickness was observed in genotype GK-T-S-2 (0.77 mm) which were at par with cv. Varigated (0.81mm) and genotype GK-T-C-2 (0.84 mm). Similar result was recorded by Rao and Janakiram (2006) ^[19] in tuberose.

The maximum number of bulbs per clump per year were observed in genotype GK-T-S-1 (12.40) which was at par with cv. Phule Rajani (12.37). However, minimum number of bulbs per clump per year was recorded in genotype GK-T-S-4 (5.80) followed by genotype GK-T-C-2 (6.77) and genotype GK-T-E-2 (7.57). The same results were recorded by Banker and Mukhopadhyay (1988) ^[5] and Naik *et al.* (2018) ^[15] in tuberose. The significantly maximum number of bulblets per clump per year were observed in cv. Phule rajani (34.72). Whereas, the lowest number of bulblets were observed in genotype GK-T-S-4 (19.00) followed by genotype GK-T-E-2 (23.07) and cv. Local Single (24.69). Similar findings were reported by Chaturvedi *et al* (2014) ^[6] in tuberose. The variation in number of bulbs per clump per year was due to variation in genetic make-up of the genotypes.

Flowering Parameters

The significantly earlier spike emergence were observed in genotype GK-T-C-2 (53.50 days) followed by cv. Local single (54.99 days) and genotype GK-T-C-4 (55.60 days). However, late spike emergence was observed in cv. Varigated (99.84 days) followed by cv. Pratap Rajani (92.59 days) and genotype GK-T-S-2 (84.53). These results were also supported by the findings of Banker and Mukhopadhyay (1988) ^[5] and Kusum (2010) ^[12] in tuberose. The significantly earlier appearance of first floret was observed in cv. Sahydari Vaman (11.60 days) followed by cv. Pratap Rajani (12.00 days) and genotype GK-T-C-4 (12.33 days). However, it was significantly delayed in cv. Local Single (18.60 days) followed by genotype GK-T-S-1 (17.67 days) and genotype GK-T-S-4 (17.40 days). The variation in this character observed was due to variation in genetic makeup of studied genotypes. Similar results were reported by Jadhav *et al.* (2020) ^[10].

The highest spike length was observed in genotype GK-T-S-1 (128.16 cm) which was at par with cv. Local Single (124.47 cm). The shortest spike length was observed in cv. Sahydri Vaman (40.29 cm) followed by genotype GK-T-E-2 (56.87 cm) and genotype GK-T-S-2 (60.09 cm). The high variation in spike length among the genotypes observed was due to their genetic traits. Similar results were reported by Patil *et al.* (2009) ^[16] and Prakash *et al.* (2016) ^[17] in tuberose. The maximum spike thickness was observed in genotype GK-T-S-4 (10.05 mm) which was at par with cv. Arka Prajwal (9.82 mm), genotype GK-T-S-1 (9.65 mm). However, the minimum spike thickness was observed in genotype GK-T-S-2 (6.87 mm) which was at par with genotype GK-T-E-2 (7.15 mm) and genotype GK-T-C-2 (7.29 mm). Similar results were recorded by Kameswari *et al.* (2014) ^[3, 11], Prakash *et al.* (2016) ^[17] in tuberose.

The significantly highest rachis length of spike was observed in genotype GK-T-S-1 (38.40 cm) followed by cv. Arka Prajwal (34.47 cm) and cv. Phule Rajani (33.69 cm). However, the minimum rachis length of spike was observed in cv. Varigated (22.75 cm) which was at par with genotype GK-T-S-2 (23.73 cm), genotype GK-T-S-4 (24.17 cm), cv. Local Single (24.91 cm), cv. Sahydari Vaman (25.41 cm), genotype GK-T-C-4 (26.17 cm), genotype GK-T-C-2 (26.23 cm). Similar results were recorded by Prakash *et al.* (2016) [17] and Desai and Chawla (2010) [8] in tuberose. Among the genotypes studied, the significantly minimum inter-floret length between first two pairs of florets was recorded in cv. Sahydari Vaman (3.95) followed by genotype GK-T-S-4 (5.00 cm) and genotype GK-T-C-2 (5.27 cm). However, the maximum inter-floret length between first two pairs of florets was recorded in genotype GK-T-S-1 (7.29 cm) which was at par with cv. Arka Prajwal (7.22 cm) and cv. Varigated (7.03 cm). Similar findings are also reported by Patil *et al.* (2009) [16] and Jadhav *et al.* (2020) [10] in tuberose.

The cv. Arka Prajwal showed significantly maximum length of floret (7.40 cm) followed by genotype GK-T-S-4 (6.80 cm) and cv. Local Single (6.57 cm). However, the cv. Pratap Rajani showed significantly minimum length of floret (4.80 cm) followed by genotype GK-T-E-2 (5.47 cm) and genotype GK-T-S-1 (5.53 cm). The variation in the length of floret might be due to different genetic make-up. Similar findings were reported by Ranchana *et al.* (2013) [18], Kameswari *et al.* (2014) [11] in tuberose. Arka Prajwal (5.13 cm) showed maximum diameter of floret which was at par with cv. Phule Rajani (5.06 cm), cv. Sahydari Vaman (4.98 cm) and genotype GK-T-S-2 (4.91 cm). However, the genotype GK-T-C-2 showed minimum diameter of floret (3.77 cm) which was at par with genotype GK-T-E-2 (3.81 cm), genotype GK-T-C-4 (3.82 cm), cv. Local Single (3.85 cm), cv. Pratap Rajani (4.02 cm) and genotype GK-T-S-1 (4.02 cm). Similar findings were reported by Patil *et al.* (2009) [16], Dimri *et al.* (2017) [9] in tuberose.

The maximum longevity of spike was observed in cv. Sahydari Vaman (25.16 days) which was at par with cv. Arka Prajwal (24.89 days). However, the significantly minimum longevity of spike was noticed in genotype GK-T-E-2 (18.93 days) followed by cv. Varigated (19.70 days) and genotype GK-T-S-1 (20.21 days). Similar result of longevity

of spike was recorded by De and Barman (1998) in tuberose. The significantly maximum interval between two spike emergence was observed in cv. Sahydari Vaman (34.33 days) followed by cv. Varigated (32.00 days) and genotype GK-T-S-4 (29.33 days). However, the significantly minimum interval between two spike emergence was observed in genotype GK-T-S-1 (21.33 days) followed by cv. Phule Rajani (22.00 days) and genotype GK-T-E-2 (22.67 days).

The significantly maximum vase life of was observed in genotype GK-T-S-1 (8.37 days) followed by cv. Sahydari Vaman (7.87 days) and cv. Phule Rajani (7.67 days). However, the minimum vase life was observed in genotype GK-T-S-2 (5.70) which was at par with cv. Local Single (5.73 days). The variation in vase life of spike might be due to different genetic make-up of the genotypes. These result was supported by Desai and Chawla (2010) [8], Patil *et al.* (2009) [16] in tuberose.

Yield Parameters

Among the 12 genotypes cv. Arka Prajwal (36.67 g) had significantly maximum weight of florets followed by genotype GK-T-S-2 (32.33 g) and cv. Pratap Rajani (27.33 g). However, significantly minimum wight of florets were found in genotype GK-T-S-4 (15.33 g) followed by genotype GKT-S-1 (19.00 g) and genotype GK-T-E-2 (20.33 g). These results were favours the findings by Jadhav *et al.* (2020) [10] and Madhumathi *et al.* (2018) [13] in tuberose. The significantly maximum number of spikes per clump per year was observed in genotype GK-T-S-1 (11.46) followed by cv. Phule Rajani (10.33) and cv. Arka Prajwal (10.11). However, the significantly minimum number of spikes per clump per year was observed in cv. Pratap Rajani (7.34) followed by cv. Local Single (7.59). These finding were supported by Banker and Mukhopadhyay (1988) [5] and Dimri *et al.* (2017) [9] in tuberose.

Among the 12 genotypes cv. Phule Rajani (51.07) had maximum number of florets which was at par with cv. Sahydari Vaman (50.80). The significantly minimum number of florets per spike was found in genotype GK-T-S-2 (37.73) followed by genotype GK-T-E-2 (40.27) and cv. Local Single (40.53). The similar finding are in agreement with the findings by Banker and Mukhopadhyay (1988) [5], Mahawer *et al.* (2013) [14] in tuberose.

Table 1: Shows bulb sprouting ranged 9.86-15.36 days, with GK-T-S-1 sprouting earliest.

Sr. No.	Genotypes	Days required for sprouting of bulbs	Plant height (cm)	Horizontal spread of plant (cm)	Leaf length (cm)	Leaf thickness (mm)	Number of bulbs/clump/year	Number of Bulblets/clump/ year
1	GK-T-S-1	9.86	133.16	74.90	52.82	0.90	12.40	29.77
2	GK-T-S-2	11.81	65.09	44.86	47.50	0.77	8.37	30.51
3	GK-T-S-4	13.77	67.35	52.39	44.57	0.94	5.80	19.00
4	GK-T-E-2	12.12	61.87	41.99	29.67	0.95	7.57	23.07
5	GK-T-C-2	10.05	77.35	63.89	58.41	0.84	6.77	25.21
6	GK-T-C-4	10.61	84.63	68.15	47.15	1.02	8.23	31.61
7	Local Single	12.42	129.47	53.96	44.72	0.88	10.27	24.69
8	Varigated	14.40	123.29	70.62	57.94	0.81	8.40	31.51
9	Sahyadri Vaman	15.36	45.29	57.04	42.11	1.01	9.70	29.99
10	Phule Rajani	11.47	80.36	60.45	48.54	0.92	12.37	34.72
11	Pratap Rajani	10.53	78.29	51.13	50.46	0.91	10.50	31.26
12	Arka Prajwal	12.66	104.33	72.19	61.31	0.88	9.63	29.80
	Mean	12.09	87.54	59.30	48.87	0.90	9.17	28.43
	SE(m)±	0.30	2.93	1.45	1.25	0.03	0.45	1.09
	CD@5%	0.12	8.65	4.28	3.71	0.08	1.32	3.32

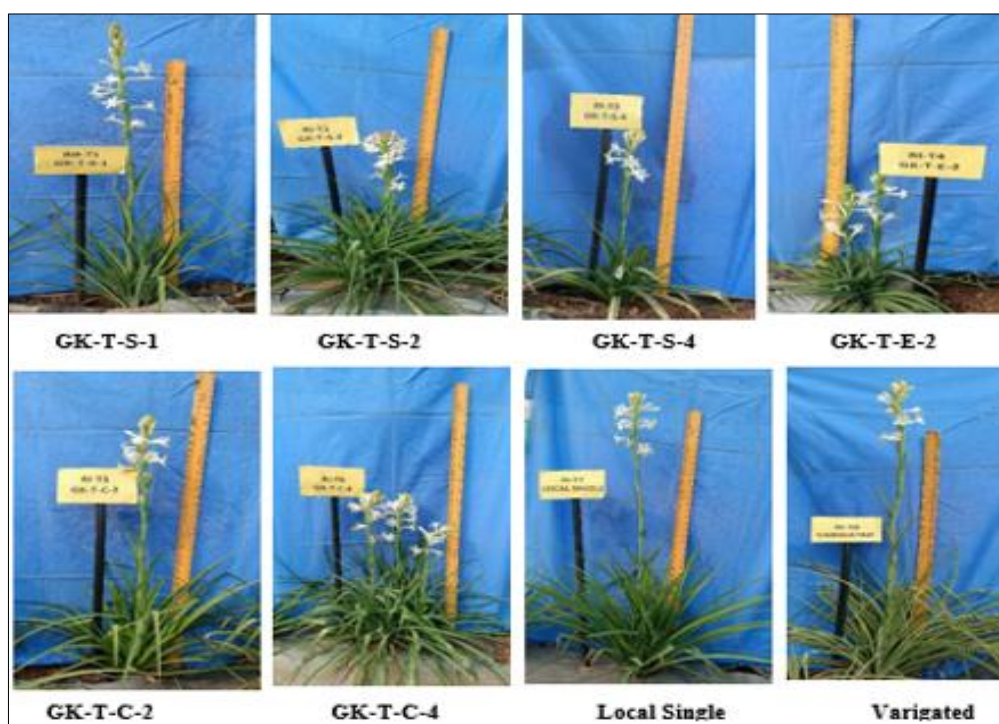
Table 2: Shows variation in spike and floret traits among genotypes, with GK-T-S-1 earliest emergence.

Treatments	Genotypes/ Varieties	Days to emerge first spike from plantation	Days to open the first floret from spike emergence	Spike length (cm)	Spike thickness (mm)	Rachis length (cm)	Inter-floret length (cm)	Length of floret (cm)
T ₁	GK-T-S-1	59.61	17.67	128.16	9.65	38.40	7.29	5.53
T ₂	GK-T-S-2	84.53	13.73	60.09	6.87	23.73	6.71	6.53
T ₃	GK-T-S-4	77.73	17.40	62.35	10.05	24.17	5.00	6.80
T ₄	GK-T-E-2	61.47	15.40	56.87	7.15	29.13	6.02	5.47
T ₅	GK-T-C-2	53.50	13.27	72.35	7.29	26.23	5.27	5.93
T ₆	GK-T-C-4	55.60	12.33	79.63	8.53	26.17	6.04	6.43
T ₇	Local Single	54.99	18.60	124.47	8.19	24.91	6.55	6.57
T ₈	Varigated	99.84	16.27	118.63	9.41	22.75	7.29	6.27
T ₉	Sahyadri Vaman	68.10	11.60	40.29	9.11	25.41	3.95	6.53
T ₁₀	Phule Rajani	58.73	16.53	75.36	8.33	33.69	6.08	5.77
T ₁₁	Pratap Rajani	92.59	12.00	73.29	7.53	30.34	6.74	4.80
T ₁₂	Arka Prajwal	58.54	15.47	99.33	9.82	34.47	7.22	7.40
	Mean	68.77	15.02	82.57	28.57	28.57	6.16	6.17
	SE(m)±	2.31	0.54	2.83	0.15	1.51	0.15	0.16
	CD@5%	0.41	0.20	3.36	0.45	4.45	0.43	0.47

Table 3: Shows the comparison of 12 gladiolus genotypes for spike longevity, diameter, vase life, and yield traits.

Treatments	Genotypes/ Varieties	Diameter of florets (cm)	Longevity of spike (days)	Interval between two spike emergence (days)	Vase life (days)	Weight of 20 florets (g)	Number of spikes/ clump/year	Number of florets/ spike
T ₁	GK-T-S-1	4.02	20.21	21.33	8.37	19.00	11.46	44.80
T ₂	GK-T-S-2	4.91	22.19	23.00	5.70	32.33	9.91	37.73
T ₃	GK-T-S-4	4.81	22.85	29.33	7.63	15.33	9.15	49.47
T ₄	GK-T-E-2	3.81	18.93	22.67	6.57	20.33	7.86	40.27
T ₅	GK-T-C-2	3.77	20.54	28.00	6.90	26.33	7.79	47.07
T ₆	GK-T-C-4	3.82	22.12	25.67	6.73	20.33	8.15	46.80
T ₇	Local Single	3.85	22.40	26.67	5.73	26.00	7.59	40.53
T ₈	Varigated	4.08	19.70	32.00	7.10	24.00	8.24	49.33
T ₉	Sahyadri Vaman	4.98	25.16	34.33	7.87	24.67	7.80	50.80
T ₁₀	Phule Rajani	5.06	23.96	22.00	7.67	24.33	10.33	51.07
T ₁₁	Pratap Rajani	4.02	20.36	26.33	6.77	27.33	7.34	48.13
T ₁₂	Arka Prajwal	5.13	24.89 ⁱ	23.00	6.87	36.67	10.11	49.60
	Mean	4.35	21.94	26.19	6.99	24.72	8.81	46.30
	SE(m)±	0.10	0.96	2.09	0.24	0.91	0.36	1.38
	CD@5%	0.31	0.30	6.14	0.13	2.69	0.18	0.30

Genotypes/ Varieties of Single Type Tuberosc





Conclusion

- Out of 12 genotypes of single type tuberose, the genotype GK-T-S-1 and Arka Prajwal were found to be promising varieties for large scale commercial production.
- Genotype GK-T-S-1 exhibited maximum plant height, spike length, rachis length, vase life and number of bulbs per clump, spikes per plant.
- Variety Arka Prajwal was found best in length of leaf, length of floret, diameter of floret and weight of florets.

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