Indian J. Hort. 67(Special Issue), November 2010: 372-377

Effect of growth regulators and bulb size on flower yield of tuberose cv. double

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ABSTRACT

The experiment entitled, "Effect of bulb size and growth regulators on flowering and flower yield of tuberose (*Polyanthes tuberosa* L.) cv. Double" was carried out at Horticulture Instructional Farm, College of Agriculture, Junagadh Agriculture University, Junagadh during 2006-07. Treatment of small daughter bulbs S_4 found superior and in case of number of leaves per plant at 100 DAP (69.38) mother bulbs (S_1) was found better. Maximum plant height (46.78 cm) was recorded in large daughter bulbs (S_2). With respect to flower characters, earlier spike emergence (111.7 days), maximum number of spikes per plant (2.5), per net plot (87.5), per hector (276666), highest number of florets per spike (30.52), maximum floret diameter (31.7mm), longest spike (66.77cm), as well as with vase life (10.63 days) was recorded in large daughter bulbs (S_2). Thiourea at 1000 ppm (G_1) resulted in outstanding superiority for most of the vegetative and flowering parameters under trial. Maximum plant height (46.28 cm) and number of leaves (65.63) at 100 DAP was resulted in thiourea 1000 ppm. The flowering parameters like number of spikes per plant (2.1), per net plot (73.5), and per hector (229630), number of florets per spike (29.89), diameter of floret (31.4 mm), length of spike (64.30 cm) and vase life (10.55 days) were found to be significantly best with same treatment.

INTRODUCTION

It is an integral part of lives in human society. The flowers are mainly used for garland, *veni,* worship, table decoration, making bouquet, *gajra*, *mandap* decoration, honey moon beds or bridal beds decoration as well as in many religious ceremonies and social functions.

Floriculture has emerged as a profitable agri-business in option in the world over in recent years, particularly in the developing nations. The international floriculture trade market is increased with more than US$ 40 billion. More than 140 countries are involved in floricultural industry. (Anon., 1).

The cut flowers like rose, gladiolus, tuberose, chrysanthemum, carnation, gerbera, orchid, anthurium, lilies etc. have commonly and frequently used for many purposes in both the local as well as international market. Among them, tuberose is one of the most important cut flower not only due to its white color flowers, attractive spike and delightful fragrance, but ease cultivation and wide adaptability to varying soils and agro-climatic condition. It occupies a place of pride in Indian floriculture industry for its beauty, excellent fragrance, better keeping quality and suitable for cut flower trade and essential oil industry as well. It also emits delightful and lingering fragrance with good appearance and it makes the atmosphere very pleasant, unsurpassable than the other flowers. It is also a popular cut flower, not only for use in arrangements, but also for the individual florets that can provide fragrance to bouquets and has great demand in market for preparation of bouquets, garlands, *veni*, beautiful floral arrangements.

Tuberose is also suitable for garden decoration and landscaping. It is also grown in pots, rockery and hangers from ancient times. Tuberose cut flowers are generally used for flowerpot in offices and bungalows. Tuberose (*Polyanthes tuberosa* L.) is popularly known as 'Rajnigandha'. It belongs to the family Amaryllidaceae. It is one of the most popular perennial flowering bulbous plants. It is a native of Mexico (Trueblood, 1973) and relative of the century plant (Agave). Tuberose inflorescences (spikes) bear 10 to 20 pairs of florets, which open from the base upward.

MATERIALS AND METHODS

The experiment was laid out in Factorial Randomized Block Design (FRBD) with three replications and twelve treatment combinations, comprising of four levels of bulb size 3.5 cm and above (S_1) 2.5-3.5 cm (S_2) 1.5- 2.5 cm (S_3), 1-1.5 cm (S_4) and three levels of thiourea including control (G_0), 1000 ppm (G_1), 2000 ppm (G_2).

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The tuberose is an important commercial flower crop of India. In recent years, the use of growth regulators in floricultural crop has undergone to enhance the yield and quality by modifying and forcing the plant growth and development. The present trial was conducted to study the effect of bulb size and growth regulators on flowering and flower yield of tuberose.

RESULTS AND DISCUSSION

The mean data revealed that, sprouting percentage of bulb significantly affected by the treatment of bulb size. Large daughter bulbs (S_2) resulted in significantly maximum sprouting (87.85%) and was at par (85.10 % and 82.87% respectively) with medium (S_3) and small daughter bulbs (S_4). Mother bulbs (S_1) gave least sprouting percentage (78.04%) but remained at par with S_4 (Table 1).

Sprouting percentage was maximum (87.38%) with thiourea at 1000 ppm and it was found at par with thiourea at 2000 ppm (G_2) whereas, significantly lowest sprouting percentage (77.6%) was observed in control (G_0) (Table 1).

The interaction effect of bulb size and growth regulators was found to be non-significant on sprouting percentage (Table 1).

The data in table indicated that bulb size was found to be significant for plant height. Large daughter bulb (S_2) resulted in maximum plant height (46.78 cm) and was at par (44.35 cm) to medium daughter bulbs (S_3). But, medium daughter bulb (S_3) was remained at par (42.99 cm) with small daughter bulbs (S_4). However, minimum plant height was recorded from mother bulb (41.62 cm), which was also found to be at par with S_4 (Table 1).

Maximum plant height (46.28 cm) was obtained with thiourea at 1000 ppm (G_1) and it was found at par (44.90 cm) with thiourea at 2000 ppm. Whereas, significantly least (40.62 cm) plant height was resulted from control (G_0) (Table 1).

The interaction effect of bulb size and growth regulators did not showed significant effect on plant height (Table 1).

An appraisal of data revealed that, significantly highest number of leaves was obtained with mother bulbs (69.31). Among daughter bulbs large daughter bulbs produced highest number of leaves (63.90), which was

Table 1. Effect of growing conditions and plant growth regulators on days to emergence, sprouting percentage, number of sprout per corm, days to first spike emergence and number of spike per plant.

Treatment	Days to emergence	Sprouting %	No. of sprout per corm	Days to first spike emergence	Number of spikeper plant
Growing conditions					
G_1 (Field condition)	21.09	53.06*(63.08)**	1.95	86.62	1.97
G_2 (Greenhouse)	19.85	58.29 (71.41)	2.09	78.13	2.23
CD at 5%	1.08	3.93 (6.14)	0.14	4.38	0.25
Growth regulators					
T_1 (Control)	23.73	39.49 (40.60)	1.37	94.17	1.36
T_2(Thiourea1000 ppm)	18.93	66.22 (83.33)	2.07	72.90	2.62
T_3(Thiourea2000 ppm)	19.46	59.21 (72.99)	2.18	75.07	2.47
T_4 (GA_3 100 ppm)	19.65	57.49 (70.16)	1.81	81.40	2.41
T_5 (GA_3 200 ppm)	19.70	57.62 (70.81)	1.90	83.00	2.47
T_6 (Kinetin 25 ppm)	20.91	53.12 (63.59)	2.46	84.83	1.64
T_7 (Kinetin 50 ppm)	20.90	56.60 (69.26)	2.36	85.27	1.75
CD at 5%	2.02	7.36 (11.48)	0.25	8.20	0.47
Interaction					
G x T	NS	NS	NS	NS	NS
CD at 5%	NS	NS	NS	NS	NS
CV (%)	8.31	11.14 (14.38)	10.56	8.39	18.84

* Arcsin percentage transformation values ** Retransform values

statistically at par with medium daughter (S_3) bulbs (60.09) but later was also found to be at par (58.16) with small daughter bulbs (S_4) (Table 1).

Highest numbers of leaves was obtained (65.63) with thiourea 1000 ppm (G_1) and it was found at par (64.26) with thiourea 2000 ppm Whereas minimum number of leaves (58.70) was observed in control (G_0) (Table 1).

Interaction effect of bulb size and growth regulators was found to be non significant for number of leaves (Table 1). .

Numbers of days to first spike emergence was significantly affected by various levels of bulb size. Large daughter bulbs (S_2) took minimum days to first spike emergence (111.7 days), which was remained at par with (118.8) with medium daughter bulbs (S_3), but S_3 was also found to be at par (121.9 days) with small daughter bulbs (S_4). Significantly highest number of days (131.2 days) was taken by the mother bulbs (S_1) to give rise first spike but also found at par with S_4 (Table 2).

The mean data show that, differences observed in days to spike emergence due to various levels of thiourea were found significant. The treatment thiourea 1000 ppm (G_1) took minimum days to spike emergence (111.7 days), which was followed (118.6 days) by thiourea at 2000 ppm (G_2). However significantly delayed spike emergence (128.5 days) was observed in control (G_0) (Table 2).

The difference due to interaction effect of bulb size and growth regulators was found to be non significant for days to first spike emergence (Table 2).

The treatment of large daughter bulbs (S_2) significantly gave highest number of spikes per plant (2.5) (Table 2).

Highest number of spikes (2.1) was obtained in thiourea at 1000 ppm (G_1), whereas, control (G_0) gave minimum spikes per plant (1.8) than other treatments. The interaction effect of bulb size and growth regulators was found to be non- significant for number of spikes per plant (Table 2).

The highest number of spikes (87.5) was obtained from large daughter bulbs (S_2) while mother bulbs (S_1) gave lowest spikes per net plot (49.0), but later remained at par to S_4 (49.0) (Table 2).

All the treatments significantly affected to each other in which maximum number of spikes (73.5) was resulted with thiourea 1000 ppm. However, treatment control (G_0) produced significantly lowest number of spikes per net plot (52.5). The effect of bulb size and growth regulators on spike per net plot was found to be non-significant (Table 2).

Table 2. Effect of growing conditions and plant growth regulators on length of spikes (cm), number of florets per spike, diameter of florets (mm) and number of spikes harvested per net plot.

Treatment	Length of spikes (cm)	Number of florets per spike	Diameter of florets (mm)	No. of spikes harvested per net plot
Growing conditions				
G_1 (Field condition)	57.96	11.62	51.97	12.13
G_2 (Greenhouse)	63.51	12.62	61.36	14.05
CD at 5%	3.97	0.94	3.29	1.57
Growth regulators				
T_1 (Control)	40.30	9.41	38.20	7.30
T_2 (Thiourea 1000 ppm)	71.64	13.54	69.00	18.08
T_3 (Thiourea 2000 ppm)	73.93	14.94	71.20	16.85
T_4 (GA_3 100 ppm)	59.66	12.03	58.70	14.05
T_5 (GA_3 200 ppm)	66.69	13.12	61.35	14.35
T_6 (Kinetin 25 ppm)	55.80	10.91	47.55	10.24
T_7 (Kinetin 50 ppm)	57.16	10.92	50.65	10.75
CD at 5%	7.43	1.76	6.16	2.94
Interaction				
G x T	NS	NS	NS	NS
CD at 5%	NS	NS	NS	NS
CV (%)	10.31	12.20	9.16	18.95

The highest number of spikes (276666) was obtained from large daughter bulbs (S_2) on the other hand mother bulbs (S_1) gave lowest spikes hector (153087), but later was found to be at par (160494) with S_4 (Table 2).

Significantly maximum number of spikes (229630) was resulted from thiourea 1000 ppm (G_1) while, treatment control (G_0) produced lowest number of spikes per hector (163704). The effect of bulb size and growth regulators on spike per net plot was found to be non-significant (Table 2).

Significantly highest number of florets per spike (30.52) was resulted from large daughter bulbs (S_2) (Table 3).

Thiourea 1000 ppm (G_1) gave highest number of florets per spike (29.89), which was followed (28.31) by thiourea at 2000 ppm (G_2). Treatment control (G_0) resulted as lowest number of florets per spike (21.48). Interaction effect of various levels of bulb size and growth regulators on number of florets per spike was found to be non-significant (Table 3).

The greatest floret diameter (31.7mm) was resulted from the large daughter bulb (S_2), which was followed (29.4 mm) by medium sized daughter bulbs (S_3). But, S_3 remained at par (28.4 mm) with small daughter bulbs (S_4), however, significantly the smallest floret diameter was measured from the mother bulbs (25.5 mm) (Table 3).

The treatment of thiourea at 1000 ppm resulted in highest floret diameter (31.4 mm), but it was found to be at par (30.2 mm) with thiourea at 2000 ppm (G_2). The minimum (24.6mm) was noted in control (G_0).The effect of bulb size and a growth regulator on diameter of floret ware found to be non-significant (Table 3).

Different treatments of bulb size significantly influenced to length of spike. Plants from large daughter bulbs (S_2) produced longest spike (66.77 cm) and it was remained at par (62.59 cm) with medium daughter bulbs (S_3), but later was found to be at par (60.86 cm) with (S_4). Shortest spikes (55.06 cm) were obtained from mother bulbs (S_1) (Table 3).

The highest length of spike (64.30 cm) was resulted from the treatment thiourea at 1000 ppm (G_1) but, it was at par (62.20 cm) with thiourea at 2000 ppm (G_2). The lowest length of spike (56.45 cm) was observed in the control (G_0).Interaction effect of bulb size and growth regulators did not show any significant influence on length of spike (Table 3).

All treatments of bulb size significantly influenced

Table 3. Effect of growing conditions and plant growth regulators on yield of spike per hectare (in lakh) , vase life (days), number of corms per plant, weight of corms per plant (g), average size of corms (cm) and number of cormels per plant.

Treatment	Spike per hectare (in lakh)	Vase life (days)	Number of corms per plant	Weight of corms per plant (g)
Growing conditions				
G_1 (Field condition)	2.11	9.87	2.33	22.69
G_2 (Greenhouse)	2.40	10.60	2.54	27.72
CD at 5%	0.29	0.72	0.18	2.68
Growth regulators				
T_1 (Control)	1.43	7.39	1.40	17.52
T_2 (Thiourea 1000 ppm)	2.82	12.01	2.40	24.92
T_3 (Thiourea 2000 ppm)	2.67	12.02	2.55	25.59
T_4 (GA_3 100 ppm)	2.61	10.85	2.10	35.25
T_5 (GA_3 200 ppm)	2.67	11.12	2.20	34.20
T_6 (Kinetin 25 ppm)	1.84	9.04	3.23	19.13
T_7 (Kinetin 50 ppm)	1.95	9.23	3.15	19.84
CD at 5%	0.52	1.35	0.33	5.01
Interaction				
G x T	NS	NS	NS	NS
CD at 5%	NS	NS	NS	NS
CV (%)	19.25	11.15	11.40	16.75

Table 4. Effect of growing conditions and plant growth regulators on average size of corms (cm), number of cormels per plant, weight of cormels per plant (g) and number of corms per hectare.

S.No.	Treatment	Average size of corms (cm)	No. of cormels per plant	Weight of cormels per plant (g)	No. of corms per ha
1	Growing conditions				
	G_1 (Field condition)	2.41	4.54	21.19	2.02
	G_2 (Greenhouse)	2.63	5.44	26.88	2.23
	CD at 5%	0.20	0.51	2.78	0.18
2	Growth regulators				
	T_1 (Control)	1.90	3.13	15.10	1.10
	T_2 (Thiourea 1000 ppm)	3.12	4.88	27.33	2.10
	T_3 (Thiourea 2000 ppm)	2.96	5.03	25.82	2.25
	T_4 (GA_3 100 ppm)	2.66	7.10	22.99	1.75
	T_5 (GA_3 200 ppm)	2.71	7.20	21.49	1.90
	T_6 (Kinetin 25 ppm)	2.11	3.73	27.69	2.93
	T_7 (Kinetin 50 ppm)	2.20	3.88	27.87	2.85
	CD at 5%	0.37	0.95	5.19	0.33
3	Interaction				
	G x T	NS	NS	NS	NS
	CD at 5%	NS	NS	NS	NS
	CV (%)	12.35	16.02	18.20	13.05

the vase life of spikes. Among the various treatments maximum days for vase life of spike (10.63 days) was observed at the treatment (S_2) i.e. large size daughter bulbs but it was found to be at par (10.10days) with medium daughter bulbs (S_3) (Table 3).

It was highest (10.55 days) in a spike, which was obtained from bulbs treated with thiourea at 1000 ppm (G_1) and was also found to be at par (10.09 days) with thiourea at 2000 ppm (G_2). Whereas, significantly shortest vase life (7.52 days) was resulted from control (G_0). The effect of different levels of bulb size and growth regulators on vase life of spike was found to be non-significant.

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Received: January, 2010; Revised: March, 2010
Accepted: August, 2010