Journal of Ornamental Horticulture, New Series Vol. 1 (1) : 6-10 (1998)

EFFECT OF NITROGEN, BULB SIZE AND PLANT DENSITY ON GROWTH, FLOWERING AND YIELD OF TUBEROSE (*POLIANTHES TUBEROSA* L.)

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ABSTRACT

In the multifactor studies in tuberose the best performance was projected with the application of 300 kg N/ha, planting larger bulbs (2.6-3.0 cm) and wider spacing of plants i.e., 30 cm apart. Application of nitrogen hastened the sprouting while largest size bulb delayed it. Minimum days for scape emergence were found at 200 kg N/ha and planting larger bulbs with lowest plant density. Spike length, floret number per spike, number of spikes per clump and bulb production in terms of quality and quantity were increased with increasing level of nitrogen, bulb size and planting distance.

Key words : *Polianthes tuberosa*, bulb, clump, scape, spike

Among the bulbous ornamentals, tuberose cv. Single, occupies a special position for its elegance, sweet fragrance and larger keeping quality. Therefore to maximise its production, the present study has been taken up.

MATERIALS AND METHODS

The experimental material consisted of 36 treatments with four levels of nitrogen (0, 100, 200 and 300 kg/ha), three sizes of bulb (1.5-2.0, 2.1-2.5 and 2.6-3.0 cm) and three planting distances (20 x 20 cm, 30 x 20 cm and 30 x 30 cm) alongwith 3 replications in a factorial randomized block design. The selected healthy and conical shaped bulbs were planted about 5 cm deep in soil on 22nd and 15th March in 1991 and 1992, respectively. Light irrigation was given after planting to accelerate their sprouting. The nitrogen was applied through urea . The half dose of nitrogen was applied at the time of planting and the remaining as top dressing in two equal instalments at 60 and 90 days after planting. A common basal dose of P_2O_5 and K_2O @ 200 kg/ha was given in all plots.

The observations were recorded only from four central plants in each treatments. The data for growth, flowering and yield parameters were taken during both the years

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of experimentation and pooled analysis was done as per method of Panse and Sukhatme (1978).

RESULTS AND DISCUSSION

It is evident from Table 1 that shoot emergence was hastened by N application and bulb size. Largest bulbs showed late sprouting as compared to smallest ones. Early sprouting in small bulbs was probably due to higher rate of metabolic activity at the active phase and delayed sprouting in large bulbs might be ascribed to the presence of more scale leaves which might have interfered in exchange of gases and inhibited metabolic process (Kamerbeek, 1962). Maximum number of leaves and height of plant were noted at 300 kg N/ha level (Table 2). The effect of nitrogen on plant growth can be explained by the fact that nitrogen is most important constituent of chlorophyll, protein and aminoacids which is in line of the work of Potti and Arora (1986) and Bankar and Mukhopadhyay (1990). The number of leaves and plant height also increased significantly with increasing bulb size and planting space. Availability of nutrients and moisture increased due to much root formation in larger bulbs, and wider spacing provides more light for photosynthesis and less competition for nutrients as have been reported by Bhattacharjee *et al.* (1979) and Yadav *et al.* (1984).

All doses of nitrogen were found to accelerate flowering significantly but 200 kg N/ha was most effective in hastening (118.92 days) the emergence of scape. The highest dose of nitrogen delayed flower scape emergence, being at par with 100 kg N/ha although maximum in control. Similar results were also found by Singh *et al.*

Table 1. Effect of nitrogen, bulb size and plant density on sprouting percentage of bulbs

Treatments	Days after planting					
	7	14	21	28	35	42
Levels of nitrogen						
N_0	12.08	34.89	53.53	63.97	75.64	100
N_1 (100 kg/ha)	14.87	43.24	63.80	72.96	88.64	100
N_2 (200 kg/ha)	16.68	44.83	72.02	74.79	89.03	100
N_3 (300 kg/ha)	16.89	43.77	70.38	74.06	92.93	100
Size of bulb						
S_1 (1.5-2.0)	15.87	42.40	65.53	72.87	86.34	100
S_2 (2.1-2.5)	15.42	41.59	64.88	71.15	86.69	100
S_3 (2.6-3.0)	14.10	41.06	64.48	70.34	86.62	100
Density of planting						
D_1 (20 x 20)	13.71	40.89	64.42	70.84	85.57	100
D_2 (30 x 20)	15.12	41.76	64.86	71.38	86.59	100
D_3 (30 x 30)	16.56	42.40	65.83	72.13	87.49	100

Table 2. Effect of nitrogen, bulb size and plant density on growth, flowering and bulb production of tuberose

Treatments	No. of leaves at peak flowering	Height of plant (cm)	Days to flowering	Periodicity of flowering (days)	Length of scape (cm)	Diameter of scape rachis (cm)	Length of inflorescence (cm)	Weight of inflorescence	Vase life of spike (days)	No. of spikes/ clump	No. of florets/ spike	No. of bulbs	Weight of bulb (g)	Weight of bulb/ clump	Diameter of bulb (cm)	No. of bulbs/ clump	Weight of bulblets/ clump
N_0 Control	102.71	35.72	137.25	13.80	75.75	0.59	26.77	24.91	8.54	1.71	27.62	6.81	10.75	67.64	2.00	3.62	5.78
N_1 100 kg N/ha	119.76	40.02	126.52	15.64	85.93	0.66	31.30	32.70	9.52	1.93	31.32	12.81	15.18	171.59	2.30	4.44	11.72
N_2 200 kg N/ha	113.80	45.77	118.92	17.75	95.33	0.74	35.31	41.18	10.01	2.14	35.67	17.15	17.58	265.16	2.56	5.14	13.62
N_3 300 kg N/ha	155.96	49.12	127.14	18.55	102.82	0.79	38.12	49.25	8.88	2.32	39.59	18.99	16.77	300.52	2.63	5.66	14.24
S_1 Small bulb (1.5-2.0 cm)	119.33	39.03	140.47	13.48	85.06	0.65	30.48	32.30	9.13	1.81	30.04	11.68	14.20	160.32	2.25	3.91	10.58
S_2 Medium bulb (2.1-2.5 cm)	128.13	42.84	124.02	17.03	89.88	0.68	33.12	37.62	9.18	2.07	34.15	13.68	15.26	200.27	2.39	4.83	12.02
S_3 Large bulb (2.6-3.0 cm)	136.73	46.10	117.87	18.78	94.93	0.76	34.96	41.09	9.40	2.21	36.46	16.15	15.76	243.10	2.47	5.41	13.65
D_1 Planting distance (20 x 20 cm)	118.72	41.62	131.56	16.08	88.10	0.68	30.13	31.50	8.55	1.87	31.41	13.65	14.52	194.02	2.12	4.32	10.87
D_2 Planting distance (30 x 20 cm)	127.97	42.24	126.81	16.33	89.83	0.70	33.13	37.70	9.35	2.04	33.94	13.78	14.94	200.34	2.39	4.76	12.16
D_3 Planting distance (30 x 30 cm)	137.47	44.10	124.00	16.89	91.95	0.71	35.21	41.80	9.81	2.17	35.30	14.09	15.75	209.33	2.60	5.07	13.22
CD at 5% N	3.540	1.420	2.686	1.460	1.970	0.115	1.740	1.520	0.260	0.155	1.520	1.13	0.54	3.61	0.020	0.120	0.690
S	1.770	1.230	2.320	1.260	1.710	0.101	1.500	1.320	0.230	0.134	1.310	0.98	0.47	3.13	0.009	0.110	0.590
D	1.770	1.230	2.320	N.S.	1.710	N.S.	1.500	1.320	0.230	0.134	1.310	0.98	0.47	3.13	0.009	0.110	0.590

(1976) and Shah *et al.* (1984). Increased bulb size and spacing also hastened the time of emergence of first flower scape. It was found minimum when largest size of bulb was used with wider spacing (30 x 30 cm). The results are in support of Sadhu and Das (1978) and Pathak *et al.* (1980). The periodicity of flowering was found maximum at highest nitrogen level, large bulb size and lowest plant density (30 cm apart) (Table 2).

The effect of various treatments was found significant in case of size of scape. The largest scapes were produced with the highest dose of nitrogen and smallest under control. Similarly, tallest scape was produced by planting large size bulbs. The findings are in conformity with Sharga (1973) and Pathak *et al.* (1980). Low plant density showed long flower scape whereas closer spacing produced shorter scape. The diameter of scape was also found maximum at highest level of nitrogen fertilization, larger bulbs and low plant density as compared to control. Further, application of nitrogen increased the length of inflorescence significantly. The largest spike (38.12 cm) was produced with an application of 300 kg N/ha, followed by 200 kg N/ha and minimum under control. The findings are in conformity to Yadav *et al.* (1985) and Bankar and Mukhopadhyay (1990). The length of spike was recorded maximum by planting large bulbs followed by medium ones as have also been recorded by Sadhu and Das (1978), and Pathak *et al.* (1980). The plant density too exerted significant effect on spike length. The longest and smallest spikes were noted under wider (30 x 30 cm) and closer (20 x 20 cm) spacings, respectively as has also been reported by Bhattacharjee *et al.* (1979). The weight of spike was found maximum with 300 kg N/ha, large bulb size and decreasing plant density. Maximum number of florets was recorded with highest dose of nitrogen as have been found by Yadav *et al.* (1985), Mukhopadhyay and Bankar (1985) and Belorkar *et al.* (1993). The highest and lowest number of florets per spike was noted by planting of largest and smallest bulbs, respectively. Maximum number of florets per spike was recorded in 30 x 30 cm spacing which was significantly superior to the rest of the treatments. The floret number per spike was reduced with increase in plant density.

Application of nitrogen, bulb size and planting density also significantly influenced the number of spikes per clump. It was maximum (2.32 spikes/clump) when highest dose of nitrogen was applied, larger bulbs were planted (2.21 spikes/clump) and plant density was decreased (2.17 spikes/clump). Flower spikes obtained from plant, treated with 200 kg N/ha showed longest vaselife (10.01 days). On the other hand spikes of large size bulb and wider spaced plants exhibited better vase life.

Maximum number (18.99) of bulbs per clump was found from plots treated with 300 kg N/ha, planting large size bulbs and in plots with low density. Weight of individual bulb was highest at 200 kg N/ha level, large bulbs and wider spacing, while bulb weight produced per clump was maximum at highest level of nitrogen. The findings are in agreement with Srivastava *et al.* (1965), Singh *et al.* (1976) and Yadav *et al.* (1985). Weight of bulb per clump was also influenced by interactive effects of treatments. Maximum diameter of bulb was in plots applied by highest dose of nitrogen,

large bulb and by wider spacing. Interactive effects of treatments also increased bulb size. Such findings have also been reported by Chauhan and Shekhawat (1971), Singh (1972) and Mukhopadhyay and Bankar (1985). Maximum number of daughter bulbs (bulblets) and weight of bulblets per clump were produced by applying highest dose of nitrogen, planting large bulbs but with low density.

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