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EFFECT OF N AND P ON GROWTH AND FLOWERING OF TUBEROSE *(POLIANTHES TUBEROSA* L.)

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Abstract: In an experiment to standardize the requirement of N and P for optimum growth and yield of flowers and bulbs of tuberose cv. Double, the treatment 30 : 30 : 15 g m^{-2} of NPK recorded maximum vegetative growth of the plants. The yield of loose flowers was also high with the same fertilizer treatment, though higher doses of P gave the highest yield, the yield of both the treatments being on par. Taking into account the use of minimum inputs to achieve maximum yield, 30 : 30 : 15 g m^{-2} of NPK was found to be the best. However, for cut flower purpose a dose of 15 : 90 : 15 g m^{-2} of NPK was found suitable. The yield of bulbs was maximum in case of the treatment 30 : 60 : 15 g m^{-2} of NPK. A significant positive correlation was recorded between single flower weight and yield of loose flowers.

Key words: Agro-techniques, fertilizers, tuberose cv. Double.

INTRODUCTION

Tuberose (*Polianthes tuberosa* L.) is one of the important bulbous ornamental crops, belonging to the family Amaryllidaceae, which is commercially cultivated for cut and loose flower purposes, besides being used for floral oil extraction. Commercial cultivation of tuberose is mainly confined to warm and humid areas with temperature ranging from 20°C to 35°C. According to Sharga (1977), high humidity and temperature around 30°C is optimum for tuberose cultivation. The requirements of N, P and K for optimum growth and yield of tuberose has been worked out for different agro-climatic conditions, earlier. The Andaman and Nicobar group of islands lies between 6°45' N and 13°41' N latitude and 92° 12' E and 93°57' E longitude, having a humid tropical climate with an average rainfall of 3000 mm annually, the mean temperature ranging from 23°C to 32°C and a high RH. There is a great demand for flowers in general and particularly for tuberose in these islands. The local requirement of flowers is being met by airlifting them from the Indian mainland resulting in higher costs.

A varietal trial undertaken previously at CARL Port Blair (Sitaram *et al.*, 1997) revealed the superiority of 'Double' tuberose cultivars over 'Singles'. Hence, the nutrient requirement of Double tuberose under the Bay island conditions for optimum growth, higher yield and bulb production, is to be standardized. The present study was conducted with these objectives.

MATERIALS AND METHODS

The experiment had seven fertilizer doses with varying N and P levels and was laid out in randomized block design, replicated four times. The experiment was conducted at the CARI, Port Blair during 1997-98. The soil texture of the experimental plot was sandy clay loam with organic carbon 0.9 per cent, available N 57 ppm, available P 2.5 ppm and available K 108 ppm. The pH of the soil was 5.0. Plots of 1.5 m x 1.5 m size were prepared, FYM @ 22.5 kg per plot was applied and incorporated. Basal dose of NPK, i.e., half the dose of N (in the form of urea), full dose of P_2O_5 and K_2O (in the form of SSP and MOP) were applied at the time of planting. The remaining dose of N was applied 2 months after planting. Biometric observations such as plant height and number of leaves per plant were recorded at monthly intervals. Data on flowering such as days taken for spike emergence, number of flowers per spike, spike weight, spike length, length of flowers, single flower weight and yield of loose flowers were also recorded. The spikes were staked to avoid damage due to lodging. After harvest, when the vegetative portion dried out, the bulbs were dug out and diameter of the bulb and number of bulblets per plant were recorded. The data were analyzed statistically and presented.

RESULTS AND DISCUSSION

Vegetative growth: At harvest, the plant height and number of leaves showed significant differences among the different fertilizer treatments (Table 1). The maximum plant height (73.03 cm) was recorded in case of fertilizer dose of 30 : 30 : 15 g m^{-2} of NPK. The same treatment recorded the maximum number of leaves (41.82 per plant). This may be due to the increased dose of nitrogen, which might have resulted in more vegetative growth. The effect of N on plant growth can be explained by the fact that nitrogen is the most important constituent of chlorophyll, proteins and amino acids. Kumar and Singh (1998) also reported maximum plant height and number of leaves at 30 g m^{-2} of N. This was in line with the earlier findings that when N dose was increased progressively from 0 to 20 g m^{-2}, the vegetative growth in tuberose also increased (Sitaram *et al.*, 1997). Similar observations were made by Banker and Mukhopadhyay (1985, 1990). The average growth rate of plants did not show any significant difference among the treatments. especially in the initial stages (1-3 months after planting).

Flowering: The days taken for spike emergence did not vary significantly among the treatments (Table 1). Spike emergence started six months after planting in treatments involving higher N levels and in the treatments having low N levels, it was delayed until 7 months after planting. Advanced flowering due to high N doses was reported by Mukhopadhyay (1981) and Banker and Mukhopadhyay (1990) in cultivar Double tuberose. However, Sitaram *et al.* (1997) reported delayed flowering when high N levels were involved. In general, the duration of flowering was one month for all the treatments in the present trial. The number of florets/spike and spike weight varied significantly with different fertilizer treatments (Table 1). The treatment 30 : 30 : 15 g m^{-2} of NPK recorded the maximum number of florets/spike (53.35) and the dose 30 : 90 : 15 g m^{-2} of NPK was also on par (52.21). The same trend was reported by Yadav et al. (1985), Banker and Mukhopadhyay (1990), Sitaram *et al.* (1997) and Kumar and Singh (1998). This might be due the increased vegetative growth resulting in greater source and hence more sink capacity

The treatment 15 : 60 : 15 g m^{-2} NPK recorded maximum spike weight (147.2 g) and the treatments 15 : 30 : 15 g m^{-2} NPK and 30 : 30 : 15 g m^{-2} NPK were also on par. Minimum spike weight was recorded in control (116.2 g). The spike length and length of florets did not differ significantly with varying fertilizer doses. This contradicts the report of Kumar and Singh (1998). Single flower weight recorded a substantial increase with increasing fertilizer levels to a certain extent and then decreased. It exhibited significant difference among treatments (Table 1).

The yield of loose flowers also varied substantially with fertilizer doses. The treatment 15 : 90 : 15 g m^{-2} NPK recorded the highest yield (31.38 t ha^{-1}) and the treatments 30 : 90 : 15 g m^{-2} NPK, 30 : 30 : 15 g m^{-2} NPK were also on par. Application of nitrogen @ 15 g m^{-2} and 30 g m^{-2} recorded remarkable increase in yield over the control. Similarly, increase in levels of phosphorus also recorded increase in yield (Table 1). With the view of minimizing input cost, the treatment 30 : 30 : 15 g m^{-2} of NPK was found to be the best. When cultivated exclusively for cut flower purpose, the optimum fertilizer dose would be 15 : 90 : 15 g m^{-2} of NPK as the plants produced lighter spikes with optimum spike length and considerably more number of florets.

The size of bulbs was significantly higher with increased nitrogen and phosphorus doses. Nitrogen at 30 g m^{-2} and phosphorus at 60 g m^{-2} gave bulbs with maximum girth (15.77 cm) and the treatments 30 : 90 : 15 g m^{-2} NPK, 15 : 60 : 15 g m^{-2} NPK, 30 : 30 : 15 g m^{-2} NPK were also on par which will considerably give higher flower yield when used for seed purpose. The control produced bulbs of smaller size (13.01 cm). Hence, a beneficial effect of higher doses of N and P was observed (Table 1). This confirms the observations of Singh (1972) and Kumar and Singh (1998) but contradicts the observation of Mukhopadhyay (1987). The number of bulblets (<2 cm in diameter) was not significantly affected by N or P application, This contradicts the earlier report of Mukhopadhyay (1987) and Kumar *et al.* (1988). The correlation coefficients (r) were worked out to determine the factors that influence yield and yield attributes (Table 2). The yield of loose flowers was influenced by single flower weight (r = 0.7291), whereas the number of florets per spike showed a very low positive correlation. The spike length recorded positive correlation with plant height and number of leaves per plant.

Table 1. Effect of different fertilizer levels on growth and yield of tuberose

N:P:K ($g\ m^{-2}$)	Plant ht. (cm)	No. of leaves/ plant	Days for flowering	No. of florets/ spike	Spike wt. (g)	Spike length (cm)	Rower length (cm)	Single flower wt. (g)	Flower yield ($t\ ha^{-1}$)	Girth of bulb (cm)	No. of bulblets
Control	60.13	20.10	200.8	51.25	116.3	97.35	4.74	1.53	24.41	13.01	26.02
15:30:15	62.30	28.02	192.3	47.67	138.2	101.56	5.02	1.56	27.68	13.92	23.73
30:30:15	73.03	41.82	185.5	53.35	135.2	104.60	4.93	1.70	29.09	14.93	21.49
15:60:15	58.10	25.02	204.8	46.09	147.2	99.09	4.80	1.83	28.15	15.05	26.07
30:60:15	63.00	30.17	187.8	46.80	121.2	100.56	4.99	1.74	27.13	15.77	23.75
15:90:15	56.08	27.57	205.0	49.09	125.9	94.57	4.99	1.92	31.38	13.29	28.49
30:90:15	61.80	34.47	198.0	52.21	120.5	101.14	4.95	1.69	29.30	15.50	24.25
CD (0.05)	1.443	0.936	NS	4.655	17.6	NS	NS	0.066	2.771	1.071	NS

Table 2. Matrix of correlation coefficients

Characters	1	2	3	4	5	6	7	8	9	10	11
1. Plant height	1										
2. No. of leaves/plant	0.800**	1									
3. Days for flowering	-0.861**	-0.667	1								
4. No. of florets/spike	0.557	0.521	-0.232	1							
5. Spike weight	0.098	0.125	0.035	-0.409	1						
6. Spike length	0.879**	0.741*	-0.820**	0.313	0.289	1					
7, Length of florets	0.172	0.511	-0.449	-0.104	0.008	0.233	1				
8. Single flower wt.	-0.361	0.087	-0.414	-0.293	0.216	-0.443	0.163	1			
9. Flower yield	-0.044	0.512	0.135	0.068	0.255	-0.078	0.601	0.729*	1		
10. Dia. of bulbs	0.379	0.567	-0.463	-0.107	0.158	0.613	0.263	0.157	0.155	1	
11. No. of bulblets	-0.915**	-0.713*	0.904**	-0.346	-0.140	-0.979**	-0.240	0.515	0.178	-0.563	1

*Singnificant at $p = 0.05$; **Singnificant at $p = 0.01$

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