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Effect of graded levels of nitrogen and phosphorus on yield and quality of Tuberose (*Polianthes tuberosa L.)*

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ABSTRACT

A field experiment was conducted to study the effect of graded levels of nitrogen and phosphorus on flower yield, bulb yield and quality of Tuberose (Polianthes tuberosa L.) cv single at the Floriculture unit, Department of Horticulture, Annamalai University, Annamalainagar during 2015-16. The treatments consisted of four levels each of nitrogen (0, 50, 100 and 150 kg ha^{-1}) and phosphorus (0, 40, 60 and 80 kg ha $^{-1}$) were evaluated in factorial randomized block design replicated thrice. The results revealed that the yield and quality of tuberose increased significantly with nitrogen application and maximum values were recorded with 150 kg N ha^{-1}, similarly phosphorus levels had significantly beneficial effect on these parameters. The highest number of florets per spike (36.21), flower yield per clump (28.67 g), flower yield (7.60 ha^{-1}), longevity of spikes in the plant (23.38 days), vase life of spikes (15.56 days), number of bulbs (8.36 plant^{-1}) and dry matter production (2768.36 kg ha^{-1}) were recorded with 150 kg N and 80 kg P_2O_5 ha^{-1}. Thus, these parameters were favorably influenced by the application of higher levels of nitrogen and phosphorus. The interaction between N and P had significant effect on flower yield, bulb yield and quality and maximum value were recorded with 150 kg N and 80 kg P_2O_5 ha^{-1}.

Keywords: Tuberose, nitrogen, bulb, vaselife

INTRODUCTION

Tuberose (*Polianthes tuberosa L.)* belongs to the family Amaryllidaceae. It is a bulbous, perennial, summer flowering ornamental crop native to Mexico. It is commercially propagated[1] by bulbs. Among different flowers, tuberose is important commercial flower crops which are extensively cultivated because of its great demand in the world market. It is widely grown for aesthetic, medicinal and commercial purpose mainly in India, France, Italy and other tropical and subtropical countries. In India, it is commercial cultivated in different states mainly Tamilnadu, Karnataka, Maharashtra and West Bengal. In South India especially in Tamilnadu cultivation of tuberose is gaining popularity. However little attention has been taken regarding to its nutritional requirement for growth, flowering and improving the yield and quality of flowers. In India, four tuberose cultivars are grown, Single, Double, Semi-Double and Variegated in which the cv. Single occupies the foremost position (Mukhopadhyay and Banker, 1986). The flower spike is used as a cut flower in vases, whereas, the single florets are utilized for making garlands and veins. The oil extracted from the tuberose is important raw material for perfumery industries (Dahal *et al.,* 2014). These waxy white flowering spikes of single flowered cultivars of tuberose with sweet lingering fragrance are in great demand. Although tuberose cultivation has been found to be a profitable enterprise, experimental evidences on its nutritional requirements are very meager. Appropriate quantity of nitrogen, phosphorus and potassium greatly influence growth and flower production. Phosphorus is an essential constituent of nucleic acids and stimulates root growth as well as increase metabolic activity in plant. Phosphorus involved in producing growth enhancing compounds, easy absorption of nutrients and which may leads to improve yield and quality of the plant. The deficiency of nutrients may cause adverse effect for growth and development of plant. The requirements of nutrients may vary due to different agro climatic conditions, plant cultivar and depending upon the type of soils. In order to meet the demand of flowers in the market, efforts are needed to manipulate the flower yield and to enhance the quality. The present study was designed to find out the optimum dose of nitrogen and phosphorus required by the crop along with a constant application of potash. Nitrogen plays an important role in various metabolic process of plant. Hence, the present study was conducted to study the effect of

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nitrogen and phosphorus on the yield and quality of the flowers in tuberose and to standardize the optimum dose of nitrogen and phosphorus for better yield and quality of tuberose.

MATERIALS AND METHODS

The field experiment was carried out at the Floriculture research unit, Department of Horticulture, Annamalai University, Annamalainagar. The treatments comprised of four levels each of nitrogen (0, 50, 100 and 150 kg ha^{-1}) and phosphorus (0,40, 60 and 80 kg ha^{-1}) were evaluated in factorial randomized block design with three replication. The experimental site was prepared and brought to a fine tilth by repeated ploughing and harrowing. Land was leveled and plots were earmarked with the size of 2 m x 2 m area. Planting was done during December 2015. The bulbs of 2.5 cm in diameter were planted to the prepared field with a spacing of 30 cm x 30 cm. The fertilizers was applied as per treatments through urea and single superphosphate (SSP) at the time of planting as basal dose and rest in two split doses at 45 and 90 days after planting. The crop was grown by adopting all agronomic practices. The observations namely number of florets in each spike, flower yield per clump, flower yield ha^{-1} , longevity of spike in the plant, vase-life of spikes, number of bulbs $plant^{-1}$ and dry matter production were recorded on the selected five plants from each treatment in each replication. The mean data were statistically analyzed by adopting standard procedures (Panse and Sukhatme, 1978).

RESULTS AND DISCUSSION

Effect of nitrogen

Increasing levels of nitrogen increased the yield parameters like number of florets per spike (31.47), flower yield per clump (23.49 g), flower yield $hectare^{-1}$ (6.56 t ha^{-1}) over control (Table 1). The increases in the yield at each level of nitrogen were found to be significant as compared to control. Nitrogen is one of the important nutrients which is essential for improvement of yield parameters. Nitrogen plays an important role in efficient metabolic activity and increased the rate of photosynthesis as it generates an important role in synthesis of proteins, aminoacid and chlorophyll and simultaneously it enhances the flower and bulb yield (Sharma and shaffat Mohammad. 2003). The quality parameters *viz.,*longevity of spike in the plant (20.42 days), vase-life of spikes (14.13 days) were also maximum with 150 kg N ha^{-1} Similarly, the number of bulbs $plant^{-1}$ (7.49) and dry matter production (2661.31 kg ha^{-1}) was also highest in the treatment which received the application of 150 kg N ha^{-1}. The improvement in flower yield, bulb yield and quality attributes with application of nitrogen could be ascribed to its

Table 1: Effect of graded levels of nitrogen and phosphorus on yield and quality of Tuberose (*polianthes tuberosa L.)*

Treatment	Number of florets per spike	Flower yield per clump (g)	Flower yield (t ha^{-1})	Longevity of spike in plant (days)	Vase-life of spikes (days)	Bulbs per plant	Dry matter production (kg ha^{-1})
Nitrogen kg ha^{-1}							
0	16.52	9.15	3.23	10.09	9.62	4.69	2317.05
50	24.52	15.99	4.98	15.47	11.95	6.19	2500.84
100	29.04	20.91	6.00	18.54	13.44	7.04	2598.71
150	31.47	23.49	6.56	20.42	14.13	7.49	2661.31
S.ED	0.51	0.42	0.11	0.33	0.14	0.08	13.22
CD (p=0.05)	1.02	0.85	0.23	0.65	0.30	0.16	23.43
Phosphorus kg ha^{-1}							
0	19.76	11.83	3.92	12.33	10.56	5.28	2391.61
40	25.31	17.24	5.18	16.05	12.26	6.35	2519.60
60	27.31	19.26	5.61	17.33	12.87	6.71	2560.03
80	29.18	21.20	6.05	18.64	13.47	7.06	2606.66
S.ED	0.26	0.19	0.07	0.18	0.09	0.04	5.84
CD (p=0.05)	0.52	0.37	0.16	0.36	0.19	0.09	11.69

pivotal role in regulation of the metabolic and enzymatic processes of respiration and simultaneously which reflected in increasing yield parameters. Similar results were reported by Devi and Singh (2010) in Tuberose and Chandana and Dorajeerao (2013) in Gladiolus**.**

Effect of phosphorus

It is explicit from the data (Table 1) that flower and bulb yield of tuberose increased with increasing dose of P_2O_5 up to 80 kg ha^{-1} as compared to control. Application of 80 kg P_2O_5 ha^{-1} produced significantly higher flower and bulb yield than other treatments. The increase in number of florets $spike^{-1}$ (29.18), flower yield $clump^{-1}$ (21.20 g), flower yield $hectare^{-1}$ (6.05 t ha^{-1}) and bulb yield (18.64) were also noticed at 80 kg P_2O_5 ha^{-1}. Application of 80 kg P_2O_5 ha^{-1} enhanced the quality characters like longevity of spike in the plant (13.47 days), vase-life of spikes (7.06 days) and dry matter production (2606.66 kg ha^{-1}). Phosphorus stimulated more number of bulblets. It is an important constituent of energy rich compounds and thus it plays an excellent role in energy metabolism. Increase in quality of florets has been attributed to the role of phosphorus in various metabolic processes such as cell division, cell development, cell enlargement and more absorption of nutrients which results in improving the yield and quality of tuberose. Phosphorus enhances the symbiotic nitrogen (N) fixation in flower crops and ultimately improved the uptake of nutrients. These findings were coincided with the results of Dishaben *et al.,* (2017) in bird of paradise, Patel *et al.,* (2006) and Dahal *et al.,* (2014) in tuberose.

Table 2: Interaction effect of N and P levels on yield and quality parameters of tuberose

Treatment	Number of florets per spike	Flower yield per clump (g)	Flower yield (t ha^{-1})	Longevity of spike in plant (days)	Vase-life of spikes (days)	Bulbs per plant	Dry matter production (kg ha^{-1})
N_0P_0	13.86	7.15	2.61	8.36	8.77	4.22	2259.19
N_0P_{40}	15.65	8.46	3.04	9.51	9.35	4.53	2297.58
N_0P_{60}	17.41	9.83	3.44	10.68	9.92	4.85	2336.62
N_0P_{80}	19.18	11.18	3.83	11.84	10.47	5.18	2374.81
$N_{50}P_0$	19.94	11.81	3.96	12.49	10.56	5.32	2396.97
$N_{50}P_{40}$	24.28	15.62	4.93	15.32	11.84	6.15	2497.15
$N_{50}P_{60}$	26.06	17.41	5.32	16.47	12.41	6.49	2535.14
$N_{50}P_{80}$	27.82	19.14	5.71	17.63	13.02	6.81	2574.12
$N_{100}P_0$	21.72	13.41	4.36	13.66	11.16	5.63	2435.16
$N_{100}P_{40}$	29.59	21.12	6.09	18.81	13.61	7.14	2612.32
$N_{100}P_{60}$	31.35	23.28	6.49	19.98	14.19	7.48	2638.00
$N_{100}P_{80}$	33.51	25.83	7.08	21.73	14.83	7.92	2709.36
$N_{150}P_0$	23.53	14.98	4.75	14.81	11.75	5.96	2475.15
$N_{150}P_{40}$	31.73	23.79	6.68	20.57	14.26	7.60	2671.38
$N_{150}P_{60}$	34.43	26.53	7.21	22.21	14.97	8.04	2730.37
$N_{150}P_{80}$	36.21	28.67	7.60	23.38	15.56	8.36	2768.36
S.ED	0.76	0.61	0.19	0.51	0.24	0.13	17.57
CD (p=0.05)	1.53	1.23	0.38	1.02	0.48	0.24	35.12

Interaction effect

Interaction effect of nitrogen and phosphorus significantly increased the flower yield, bulb yield and quality characters in tuberose (Fig. 1 and Table 2). The combined application of 150 kg N and 80 kg P_2O_5 ha^{-1} was considered as the best treatment in terms of flower, bulb yield and quality characters over the rest of treatment combinations. The maximum number of florets per spike (36.21), flower yield per clump (28.67 g), flower yield per hectare (7.60 t ha^{-1}) was noticed at 150 kg N and 80 kg P_2O_5 ha^{-1}. Combined application of nitrogen and phosphorus enhances the quality characters like longevity of spike in the plant (15.56 days), vase-life of spikes (8.36 days), bulb yield (23.38) and dry matter production (2768.36 kg ha^{-1}). The increase in yield and quality parameters might be due to the nitrogen and phosphorus which helps in the formation of sugar and starch in the flower crops (Acharya and Dashora, 2004). The data on yield and quality parameters were significantly influenced by interactions of nitrogen and phosphorus which enhanced the maximum yield with higher levels of nitrogen and phosphorus whereas the lower level of N and P was insufficient to fulfil the nutrient requirements for growth and development of the plants. Higher levels of N and P encouraged the growth and

development of this flower crop during the reproductive stage. This nutrient combination achieved higher yield and quality until the the final stage of the crop resulting with maximum performance of the crop. These results are in conformity with those reported by Kumar and Misra (2011) in gladiolus and Swetha *et al.,*(2018) in asiatic lily.. The lowest values of these parameters were recorded under control (no nitrogen and no phosphorus).

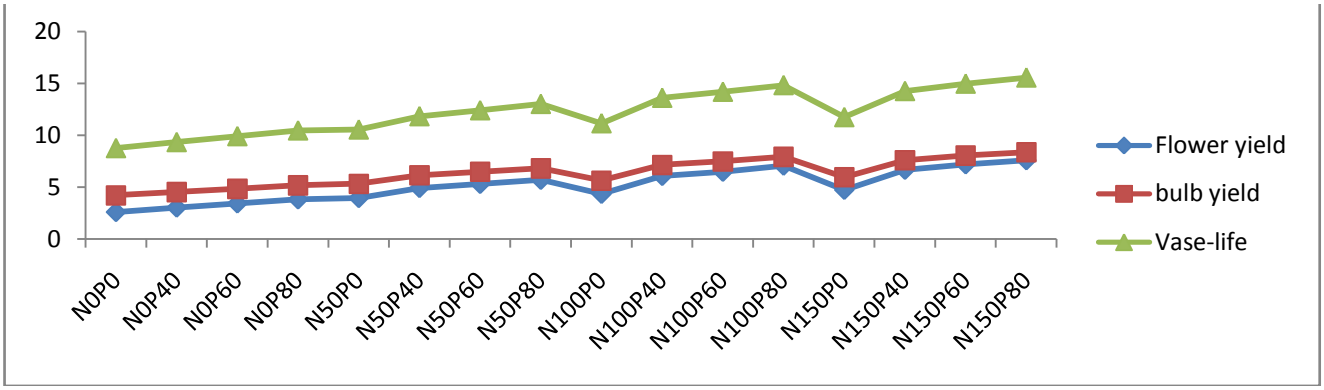

Fig. 1: Interaction effect of N and P levels on yield and quality parameters of tuberose

From the results, it may be concluded that combined application of nitrogen and phosphorus @ 150 and 80 kg ha^{-1} had significant impact on flower, bulb yield and quality characters of Tuberose. Thus, it seems quite logical to apply nitrogen and phosphorus with sufficient dose on medium sandy loamy soil of coastal ecosystem of Cuddalore district, Tamil nadu to obtain economic yield of tuberose.

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