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Influence of different nutritional treatments on growth and bulb production of tuberose, *Polianthes tuberosa* L cv Double

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ABSTRACT

Sixteen different fertilizer treatments were accessed in a factorial randomized block design on growth parameters in tuberose, *Polianthes tuberosa* L cv Double at experimental farm of the Department of Floriculture and Landscape Architecture, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, HP during the year 2010-11. Among the different treatments 200 kg N/ha + 100 kg P_2O_5/ha recorded maximum sprouting of bulbs (100%), plant height (48.38 cm), number of leaves per plant (47.59), number of bulbs produced per plant (16.68) and bulbs per plant (276.03 g).

Keywords: Tuberose; flowering; nitrogen doses; phosphorous doses; nutrition

INTRODUCTION

Tuberose, *Polianthes tuberosa* L is native to Mexico and belongs to family Amaryllidaceae. It is one of the most important commercial bulbous ornamentals of sub-tropical and tropical areas commonly called as Rajnigandha. The increased production of quality flowers and bulbs per plant is the main objective to be reckoned in commercial flower production of tuberose. Though the quality of cut flowers is primarily a varietal trait but it is greatly influenced by climatic, geographical and nutritional factors among which the nutrition plays a very crucial role. The nutritional requirements of tuberose vary with the prevailing climatic conditions and soil types besides the availability of nutrients in the soil. The information regarding nutrition of tuberose is very scanty and exhibited wide variation in terms of quantity of nutrients to be applied for different tuberose growing areas (Singh and Godara 1995, Yadav et al 1985).

Tuberose is a heavy feeder of NPK and responds well to the organic and inorganic nutrient application particularly nitrogenous fertilizers (Sadhu and Bose 1973). Among the major nutrients required for the optimum growth, development and flowering of tuberose, nitrogen has greater influence right from cell division to the development of vegetative and reproductive organs. It is an integral component of nucleic acids, proteins, protoplasm and chlorophyll. It is one of the most mobile of all the mineral nutrients absorbed by the plants. In determining the yields of flower crops, phosphorus is also one of the major and crucial limiting factors as it is directly involved in most life processes viz photosynthesis, respiration and other metabolic processes. Deficiency of phosphorus may adversely affect the plant in maintaining the full supply of N and K. To date a very little work has been conducted to ascertain the efficacy of fertilizers on commercial bulbous ornamental crops particularly the tuberose under mid-hill conditions of Himachal Pradesh. Therefore the present study was undertaken to optimize doses of nitrogen and phosphorus for tuberose cultivation under mid-hill areas of the state.

MATERIAL and METHODS

The research farm of the department of Floriculture and Landscape Architecture, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan is located at 30°52′30″ North latitude and 77°11′30″ East longitude at an altitude of 1276 meters amsl. The area falls in the mid-hill zone of Himachal Pradesh. The climate here is generally sub-temperate to sub-tropical characterized by mild summers and cool winters.

The experiment comprised sixteen treatment combinations of different doses of nitrogen (0, 100, 200 and 300 kg/ha) and phosphorus (0, 50, 100 and 150 kg/ha) replicated thrice. Half dose of nitrogen and full dose of phosphorus were applied as basal dose just before planting of bulbs while remaining half dose of the nitrogen was applied after one month of planting. Nitrogen was applied in the form of urea and phosphorus in the form of single super phosphate (SSP). A uniform dose of potassium @ 150 kg/ha in the form of muriate of potash (MOP) was given as basal dose in all plots including control before the planting of bulbs.

The healthy and disease-free tuberose bulbs of requisite and uniform size were selected and used for the experimental studies. The beds of size 1 x 1 m in length and breadth were prepared . The bulbs were spaced 25 x 25 cm apart thereby accommodating 16 bulbs per plot of size one square meter. Vermicompost (2.5 kg/m^2) was applied uniformly and mixed well in the soil prior to planting. A successful tuberose crop stand was raised by following the standard cultural practices except various treatments of inorganic fertilizers (NPK). Irrigation twice a week during summer and once a week in winter was applied while during the rainy season irrigation was done as and when needed depending upon weather conditions. From time to time weeding and hoeing of the field was done. Although tuberose is not so prone to insects-pests and diseases yet all the precautionary measures were taken into consideration throughout the cropping period.

The observations on various growth, flowering and bulb production attributes of tuberose were recorded. The soil was analyzed for various physico-chemical properties viz macronutrients (NPK), pH, electrical conductivity (EC) and organic carbon (OC) before planting and after harvesting of the crop. The initial physico-chemical properties of the medium indicated that it contained 384.07 kg N, 39.42 kg P and 127.74 kg K/ha. The electrical conductivity was 0.75 dS/m with organic carbon content of 1.20 per cent and pH of 7.30. Available N was determined by alkaline potassium permanganate method (Subbiah and Asija 1956), phosphorous by Olsen method (Olsen et al 1954) and pottassium by neutral ammonium acetate method (Merwin and Peech 1951). Organic carbon was determined by chromic acid titration method (Walkley and Black 1934). All the data pertaining to growth, flowering and bulb production characters were subjected to statistical analysis as per randomized block design (factorial) suggested by Gomez and Gomez (1984).

RESULTS and DISCUSSION

Days taken to sprouting of bulbs

Among the different N doses minimum time taken for sprouting (14.74 days) was recorded with the application of N_3 (300 kg N/ha) whereas maximum time (21.57 days) for sprouting of bulbs was recorded in control (N_0). In case of phosphorus minimum time (15.68 days) for sprouting of bulbs was recorded with the application of P_3 (150 kg P_2O_5/ha) and was found to be significantly earlier over all other treatments whereas maximum time (19.57 days) taken for sprouting of tuberose bulbs was recorded in control (P_0) which was found to be at par with P_1 (19.47 days). The interaction effect revealed minimum time (12.73 days) for sprouting with N_3P_3 (300 kg N/ha + 150 kg P_2O_5/ha) and maximum number of days (23.17 days) for sprouting with N_0P_0 (control). Early sprouting in tuberose with higher doses of nitrogen, phosphorus and their interaction might be due to the stimulation of bulbs by comparatively high nutrient availability (N and P) and their respective absorption through bulbs surface and primary roots. These findings are in close agreement with the earlier work of Singh et al (1976) as well as Dahiya et al (2001) who opined the same reason for the hastening of sprouting in tuberose with the application of higher doses of nitrogen and phosphorus.

Per cent sprouting of bulbs

Per cent sprouting of bulbs was significantly influenced by nitrogen and phosphorus doses and their interaction. As regards the effect of nitrogen, plants raised with the application of N_2 (200 kg N/ha) observed maximum sprouting (99.97%) which was at par with N_3 (300 kg N/ha) recording 99.81 per cent sprouting. Among the different phosphorus doses, plants raised with P_2 (100 kg P_2O_5/ha) recorded maximum sprouting (97.38%) which was found to be statistically at par with P_0 (0 kg P_2O_5/ha) and P_3 (150 kg P_2O_5/ha) recording 97.12 and 96.90 per cent sprouting respectively. Interaction between N x P showed maximum (100%) sprouting with N_2P_2, N_2P_3, N_3P_2 and N_3P_3. These interactions were found to be statistically at par with N_2P_0, N_3P_0, N_2P_1 and N_3P_1. Minimum sprouting (90.47%) of bulbs was observed in N_0P_1 followed by N_0P_3 (90.68%) and N_0P_2 (91.55%). The sprouting of tuberose bulbs increased significantly with the increasing doses of nitrogen, phosphorus and their interaction which may be due to the higher availability of nitrogen and phosphorus. These findings are in close agreement with the earlier findings of Sukhda (1999).

Number of leaves per plant

Data pertaining to the effect of nitrogen and phosphorus on number of leaves per plant are presented in Table 1. Significantly highest number of leaves per plant (46.98) was recorded in 200 kg N/ha (N_2) which was at par with 300 kg N/ha (N_3) whereas minimum number of leaves (36.45) was recorded in control. The phosphorus application showed maximum number of leaves (43.97) with 100 kg P_2O_5/ha (P_2) which was at par with 150 kg P_2O_5/ha (P_3). The interaction N x P also affected number of leaves per plant significantly. Maximum number of leaves per plant (47.59) was recorded with treatment combination N_2P_2 and was found to be at par with N_2P_3, N_3P_1, N_3P_3, N_3P_0 and N_2P_0.

The application of nitrogen and phosphorus exhibited positive correlation with the number of leaves per plant and consequently the number of leaves per plant increased with the increasing doses of nitrogen and phosphorus in alone as well as in combination. Nitrogen is a constituent of protein and is essential for formation of protoplasm, in cell division and in cell enlargement and also increases the chlorophyll content in leaves while phosphorus a part of nucleic acid is responsible for root development. Hence the combined effect of higher availability of both nutrients in plant vicinity enhances the vegetative growth of the plant. The present findings get the support from the work of Yadav et al (2005a) and Devi and Singh (2010).

Plant height (cm)

Data presented in Table 1 reveal that maximum plant height (48.07 cm) was recorded with 200 kg N/ha (N_2) which was found to be at par with N_3 (300 kg N/ha). As regards the effect of phosphorus, tallest

Table 1. Effect of nitrogen and phosphorus and their interactions on growth and bulb parameters in tuberose, *Polianthes tuberosa* L cv Double

Treatment	Days taken to sprouting	Per cent sprouting of bulbs	# leaves /plant	Plant height (cm)	# bulbs produced /plant	Weight of bulbs /plant (g)
N_0	21.57	91.37 (9.61)	36.45	42.65	10.52	143.34
N_1	17.53	96.61 (9.88)	41.43	44.87	12.31	182.93
N_2	16.98	99.97 (10.05)	46.98	48.07	16.05	251.56
N_3	14.74	99.81 (10.04)	46.93	47.86	16.28	263.42
$CD_{0.05}$	0.37	0.04	0.78	0.60	0.40	1.18
P_0	19.57	97.12 (9.90)	41.86	45.37	13.25	197.06
P_1	19.47	96.35 (9.87)	42.01	45.52	13.28	199.13
P_2	16.10	97.38 (9.92)	43.97	46.29	14.37	224.07
P_3	15.68	96.90 (9.89)	43.94	46.27	14.27	220.99
$CD_{0.05}$	0.37	0.04	0.78	0.60	0.40	1.18
N_0P_0	23.17	92.77 (9.68)	35.20	41.89	9.51	124.38
N_0P_1	22.91	90.47 (9.56)	35.29	42.02	9.57	126.65
N_0P_2	20.56	91.55 (9.62)	37.60	43.22	11.61	162.72
N_0P_3	19.64	90.68 (9.58)	37.69	43.45	11.40	159.60
N_1P_0	19.48	95.80 (9.84)	39.12	44.07	11.73	170.45
N_1P_1	19.71	95.73 (9.84)	39.14	44.32	11.76	175.14
N_1P_2	15.58	97.97 (9.95)	43.68	45.54	12.88	194.11
N_1P_3	15.34	96.95 (9.90)	43.76	45.55	12.85	192.01
N_2P_0	18.60	99.97 (10.05)	46.39	47.85	15.55	230.30
N_2P_1	18.98	99.90 (10.05)	46.53	47.97	15.58	231.42
N_2P_2	15.33	100 (10.05)	47.59	48.38	16.68	276.03
N_2P_3	15.00	100 (10.05)	47.42	48.06	16.38	268.51
N_3P_0	17.03	99.93 (10.05)	46.73	47.65	16.19	263.12
N_3P_1	16.29	99.30 (10.02)	47.09	47.77	16.20	263.30
N_3P_2	12.92	100 (10.05)	47.01	48.00	16.30	263.43
N_3P_3	12.73	100 (10.05)	46.90	48.02	16.43	263.84
$CD_{0.05}$	0.73	0.04	1.56	NS	0.81	2.37

Values in parentheses are the square root transformed of the original values plants (46.29 cm) were produced with 100 kg P_2O_5/ha (P_2) which was found to be statistically at par with 150 kg P_2O_5/ha (P_3). Interaction effects between N x P were found to be non-significant. The application of nitrogen and phosphorus exhibited positive correlation with the plant height and consequently the plant height increased with the increasing doses of nitrogen and phosphorus in alone as well as in combination. The present findings get the support from the work of Dahiya et al (2001), Yadav et al (2005a) and Devi and Singh (2010).

Number and weight of bulbs per plant

Maximum number of bulbs produced per plant (16.28) was recorded with N_3 (300 kg N/ha) which was at par with N_2 (200 Kg N/ha). Plants supplied with P_2 (100 kg P_2O_5/ha) recorded maximum number of bulbs per plant (14.37) which was at par with P_3 (14.27) and minimum (13.25) was recorded in P_0 (control). Interaction N × P revealed maximum number of bulbs per plant (16.68) with N_2P_2 which was at par with N_2P_3, N_3P_3, N_3P_2, N_3P_1 and N_3P_0 whereas N_0P_0 registered minimum number of bulbs per plant (9.51).

Maximum weight of bulbs per plant (263.42 g) was observed in N_3 (300 kg N/ha). P_2 (100 kg P_2O_5/ha) recorded the maximum weight of bulbs produced per plant (224.07 g). In case of interaction of N and P, the maximum weight of bulbs per plant (276.03 g) was recorded with N_2P_2 (200 kg N/ha + 100 kg P_2O_5/ha). Similar trends have also been reported earlier by Devi and Singh (2010), Singh et al (1996), Yadav et al (2005b) and Sharma et al (2008) in tuberose.

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