Plant Archives Vol. 19 No. 2, 2019 pp. 3620-3622 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

EFFECT OF SPACING AND ZINC APPLICATION ON GROWTH PARAMETERS OF TUBEROSE (*POLIANTHES TUBEROSA* L.) CV. SINGLE

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Abstract

The present investigation on the "Effect of spacing and zinc application on growth parameters of tuberose (*Polianthes tuberosa* L.) cv. Single" was carried out in the Floriculture Unit, Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalainagar, Tamil Nadu. The Experiment was designed following the principles of split plot design with four main plots (Ridge and furrow system - 45 × 20 cm, Bed system - 45 × 20 cm, 30 × 20 cm and 25 × 20 cm) and four sub plots (Zinc @ 0, 5, 10, 20 kg/ha) consisting of sixteen treatment combinations in total. Each treatment was replicated thrice. The results of the present investigation revealed that among the interaction effects, the highest values was observed for plant height (61.78 cm), number of side shoots per plant (8.21), number of leaves per plant (41.69) and leaf area (47.13 cm^2) in M_2S_4 (45 × 20 cm spacing followed in bed system along with zinc @ 20 kg ha^{-1}) and the lowest values for growth parameters were reported in M_1S_1 (45 × 20 cm spacing followed in ridge and furrow system along with zinc @ 0 kg ha^{-1}).

Key words : Tuberose, spacing, zinc, growth.

Introduction

Tuberose (*Polianthes tuberosa* L.) is an ornamental bulbous plant belongs to the family Amaryllidaceae. It is an important, popular flower crop being cultivated on a large scale for its scented flower in many parts of the world and in plains of India. Among the ornamental bulbous plants valued for their beauty and fragrance of the flowers, the tuberose occupies a very selective and special position. The flowers remain fresh for long time and withstand long distance transportation and find the useful place in the flower market. This fragrant bulbous plant blooms profusely in summer and winter seasons. It is commercially cultivated for cut and loose flowers used for garland making, decoration and also the flowers are good source of essential oils (Yadav *et al.,* 2003). It has good export potentiality because of more popular than ever in Europe, where the flowers are not available during winter months.

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The increased productivity of flower crop can appreciably be achieved through adoption of improved cultural practices. It has been established that spacing and nutrients play an important part in overall improvement of growth and yield of many flower crops. In tuberose, its successful cultivation is influenced by various agro techniques including optimum spacing (Patel *et al.,* 2006). The optimum spacing helps not only in obtaining increased production of better quality but also in proper utilization of land and other inputs (Ramesh Kumar *et al.,* 2003). Therefore, an effort was made to find out the suitable spacing for tuberose cv. Single to achieve highest flower yield.

Nutrient management plays an important role in maximizing the yield of crops. The work on standardization of macronutrient requirement and application has been done by various workers. Recent insight into the reasons for yield plateau in many crops has shown that due to repeated application of only macro elements and

continuous cropping has depleted the micronutrients. Widespread deficiencies of micronutrients both hidden and visual have also been reported as the major reason for declining productivity. Keeping in view of these facts, the present study was carried out to find out the optimum spacing and level of zinc application for obtaining highest growth of tuberose.

Materials and Methods

The investigation on "Effect of spacing and zinc application on growth parameters of tuberose (*Polianthes tuberosa* L.) cv. Single" was carried out in the Floriculture Unit, Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalainagar, Tamil Nadu. Bulbs of tuberose cv. Single obtained from the farmer's field at Nilakottai area, Dindigul district, Tamil Nadu was used as the experimental crop. The Experiment was designed following the principles of split plot design with four main plots (Ridge and furrow system - 45 × 20 cm, Bed System - 25 × 20 cm, 30 × 20 cm. 45 × 20 cm) and four sub plots (Zinc @ 0, 5, 10, 20 kg/ha) consisting of 16 treatment combinations in total. Each treatment was replicated thrice. In each replication, five plants were tagged for observation leaving border rows.

Zinc was applied basally in the form of zinc sulphate which is the commonly available form to the farmers. The fully opened flowers were harvested during the early hours of morning. The flowers were picked at three days interval and the flower yield was recorded. Five plants were selected at each treatment from all three replications, labeled and used for recording the parameters. Data pertaining to vegetative characters such as plant height, number of side shoots and leaves, leaf area, etc, were recorded. The statistical analysis of data was done by adopting the standard statistical procedure given by Panse and Sukhatme (1978). The critical difference was worked out for five per cent (P=0.05) probability.

Results and Discussion

Among the two different types of farming systems (ridge and furrow system, bed system) tried to evolve the best one for tuberose cultivation, bed system excelled over ridge and furrow system in terms of growth attributes. From the results of the experiment, it was observed that various levels of spacing, zinc and their interactions exhibited significant variation on growth parameters (Table 1). Studies carried out to optimize the spacing for tuberose revealed that there was an increase in plant height, number of side shoots per plant, number of leaves per plant and leaf area with wider spacing at all the stages of plant growth. The wider spacing of 45 × 20 cm followed in bed system favoured the plant growth in terms of plant height (59.32 cm), number of side shoots per plant (7.70), number of leaves per plant (38.47) and leaf area (40.94 cm^2) as compared to closer spacings (30 × 20 cm and 25 × 20 cm). Planting density affects the growth of plant canopy by light interception. With increase in plant spacing, light interception and solar energy conversion efficiency will be maximum which might be the reason for variation in plant height and number of side shoots per plant at different spacings. This is in line with the findings of Desai *et al*., (2005) in tuberose, Dalvi *et al*., (2008) in gladiolus and Ranveet Kour (2009) in chrysanthemum.

Wider spacing gives more space to plant to derive more nutrients from the soil and reduced competition between the plants for nutrients, moisture and light might have helped in more photosynthetic activities as suggested by Sharma and Gupta (2003) in gladiolus. Leaves are the main photosynthetic apparatus in plant system to synthesize various metabolites required for plant growth and development. According to Yadav *et al*., (2005) in tuberose, under wide row spacing there was less competition for moisture, nutrients and light and the lateral spread of plants was more, which resulted in significantly increased number of leaves and leaf area per plant.

In the present study, it was observed that application of zinc significantly increased the plant height, number of

Table 1: Effect of spacing and zinc application on growth parameters of tuberose (*Polianthes tuberosa* L.) cv. Single.

Treatments	Plant height (cm)	Number of side shoots per plant	Number of leaves per plant	Leaf area (cm^2)
MAIN (M) - Spacing				
M_1 - Ridge & furrow - 45 × 20 cm	53.68	6.31	31.43	26.96
M_2 - Bed system – 45 × 20 cm	59.32	7.70	38.47	40.94
M_3 - Bed system – 30 × 20 cm	56.13	6.94	34.42	32.95
M_4 - Bed system – 25 × 20 cm	58.54	7.51	37.41	39.03
S.ED	0.01	0.01	0.03	0.02
CD (P=0.05)	0.03	0.03	0.07	0.05
SUB (S) - Zinc				
S_1 - 0 kg ha^{-1}	54.23	6.45	31.99	28.24
S_2 - 5 kg ha^{-1}	56.02	6.93	34.28	32.70
S_3 - 10 kg ha^{-1}	57.92	7.36	36.69	37.48
S_4 - 20 kg ha^{-1}	59.51	7.72	38.76	41.45
S.ED	0.02	0.01	0.01	0.01
CD (P=0.05)	0.05	0.03	0.03	0.02

Table 2: Interaction effect of spacing and zinc application on growth parameters of tuberose (*Polianthes tuberosa* L.) cv. Single.

Treatments	Plant height (cm)	Number of side shoots per plant	Number of leaves per plant	Leaf area (cm^2)
M_1S_1	52.09	5.90	29.39	23.46
M_1S_2	52.89	6.09	30.68	24.84
M_1S_3	53.98	6.38	31.73	27.52
M_1S_4	55.77	6.89	33.95	32.02
M_2S_1	56.49	7.08	34.81	33.61
M_2S_2	58.61	7.59	37.58	39.18
M_2S_3	60.42	7.93	39.82	43.86
M_2S_4	61.78	8.21	41.69	47.13
M_3S_1	53.27	6.15	31.03	25.66
M_3S_2	54.70	6.63	32.40	29.47
M_3S_3	57.21	7.27	35.72	35.56
M_3S_4	59.36	7.72	38.53	41.14
M_4S_1	55.09	6.69	32.75	30.26
M_4S_2	57.90	7.41	36.48	37.32
M_4S_3	60.07	7.87	39.52	43.00
M_4S_4	61.13	8.08	40.89	45.54
S.ED	0.04	0.03	0.04	0.03
CD (P=0.05)	0.09	0.06	0.09	0.06

side shoots per plant, number of leaves per plant and leaf area at all the stages of plant growth. Application of zinc @ 20 kg ha^{-1} resulted in the production of highest plant height (59.51 cm), number of side shoots (7.72) and leaves $plant^{-1}$ (38.76) along with greater leaf area (41.45 cm^2). The results of the present study are in line with the findings of Katiyar *et al*., (2005) in gladiolus and Jat *et al*., (2007) in African marigold.

The increase in vegetative growth characters of tuberose due to the application of zinc sulphate might be on account of synthesis of trptophan, a precursor of indole acetic acid (auxin) which is accelerated by zinc as such helps the plant to maintain apical dominance, polarity and growth as suggested by Chattopadhyay (1994). Zinc is required for all metabolic activities and ultimately for growth of plants. Bhattacharjee and Singh (1992) opined that zinc increased the chlorophyll content of the leaves, which accelerated photosynthetic activity and induced vigorous growth. The results of the present investigation revealed that among the interaction effects table 2, the highest values was observed for plant height (61.78 cm), number of side shoots per plant (8.21), number of leaves per plant (41.69) and leaf area (47.13 cm^2) was observed in M_2S_4 (45 × 20 cm spacing followed in bed system along with zinc @ 20 kg ha^{-1}) and the lowest values for growth parameters were reported in M_1S_1 (45 × 20 cm spacing followed in ridge and furrow system along with zinc @ 0 kg ha^{-1}). On the basis of the above results, it could be concluded that planting of tuberose bulbs at the spacing of 45 × 20 cm followed in bed system and soil application of zinc @ 20 kg ha^{-1} can be recommended for realizing highest growth in tuberose.

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