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GROWTH AND YIELD OF TUBEROSE AS INFLUENCED BY MICRONUTRIENTS

Madhuri Tayade[1], Shalini Badge[2], Snehal Bayaskar[3] and Chetan Wasnik[4]

ABSTRACT

An experiment entitled "Growth and yield of tuberose as influenced by micronutrients" was carried out during of *kharif* season the year 2016-2017 at Horticulture Section, College of Agriculture, Nagpur with sixteen treatment combinations in Factorial Randomized Block Design. The treatments comprised of foliar application of four levels of zinc *viz.*, control (water spray), zinc-0.2%, zinc-0.4% and zinc-0.6% and four levels of iron *viz.*, control (water spray), iron-0.2%, iron-0.4% and iron-0.6%.The results revealed that, foliar application of 0.4% zinc and 0.4% iron recorded significantly maximum plant height (59.75 cm & 60.10 cm, respectively), number of leaves clump^{-1} (49.18, & 49.33, respectively), leaf area (88.96cm^2 & 93.32 cm^2 respectively), number of spikes plant^{-1}(2.32 & 2.36, respectively), plot^{-1}(66.72 &68.04, respectively), ha^{-1}(1.78 lakh & 1.81 lakh, respectively), number of florets spike^{-1}(31.57 & 32.01, respectively) and weight of 10 florets (9.16 g & 9.33 g, respectively). However, interaction effect of zinc and iron on growth and yield parameters of tuberose was found to be non-significant.

INTRODUCTION

Tuberose (*Polianthes tuberosa* L.) an important commercial flower crop belongs to family Amaryllidaceae, is native of Mexico. In India, it is popularly known as Rajanigandha, Nishigandha, Sugandharaja, Gulcheri, and Gul-eshahu. Tuberose is much adorned for its colour, elegance and fragrance. Among the commercially grown flowers, Tuberose occupies prime position in India since it is used as cut flower, loose flower as well as for its potential in perfume industry. Tuberose is cultivated in many tropical and subtropical parts of world including India.The whole fragrant flowers are popularly used for making garland and also for essential concrete extraction. Growing of tuberose in soil with higher PH range (>7.5 to 8.0) makes many micronutrients unavailable to the crop and there is a possibility of the micronutrient deficiencies, inhibiting the growth and development.

The role of micronutrients is non crucial in tuberose production as well as major nutrients in growth and developments. Zinc is indispensable for proper growth development of plant. Zinc is effective plant nutrition for the synthesis of plant hormones and balanced intake of P and K inside the plant cells. Zinc deficiency in plants resulted in stunted growth, little leaf and fruit sizes which are attributed to altered IAA metabolism. Application of zinc improved the plant growth, pigments of necrotic leaf of plants including leaf size and yield of spike.

As a constituent of various enzymes, iron plays the part of a vital catalyst in plant. Iron act as catalyst in synthesis of chlorophyll molecule and helps on the absorption of other elements. It is a key element in various redox reactions of respiration, photosynthesis and reduction of nitrates and sulphates. Iron deficiency is common in alkaline soil with typical chlorosis; the young leaves turning yellowish with vein remaining green. Iron application increased the levels of all leaf pigments, but the extent of increased in level depend on the pigment affected and phosphorus metabolism and synthesis of RNA. Few studies were carried out in foliar application of Zn and Fe in tuberose under our Nagpur agro-climatic conditions. The micronutrients especially zinc and iron is necessary in every stage of plant growth in tuberose. Therefore, keeping in view the above facts an experiment was carried out to investigate the effect of zinc and iron on growth and yield of tuberose cv. Local during the year 2016-17.

MATERIALS AND METHODS

Field experiment was carried out at Floriculture Unit, Horticulture Section, College of Agriculture, Nagpur during *kharif* season of the year 2016-2017 with objective to find out the suitable concentration of zinc and iron for better growth and yield of tuberose. The experiment laid out in Factorial Randomized Block Design with sixteen treatment combinations replicated thrice. The treatments

1,3 & 4. P. G. Students, Horticulture Section, College of Agriculture, Nagpur
2. Asstt. Professor, Horticulture Section, College of Agriculture, Nagpur

comprised of foliar application of four levels of zinc *viz.,* control (water spray), zinc-0.2%, zinc-0.4% and zinc-0.6% and four levels of iron *viz.*, control (water spray), iron-0.2%, iron-0.4% and iron-0.6%.

The field selected for experiment was uniform texture and leveled. The experimental field was prepared by ploughing and cross wise harrowing. Farm yard manure was applied @ 20 t ha^{-1} at last harrowing and mix well in the soil. Layout of broad ridge furrow was prepared in Factorial Randomized Block Design of a dimension of 0.8 m × 1.6 m. Tuberose bulbs having uniform size (20-30 g) was selected for planting. Planting was done at 30 cm x 30 cm spacing on 6th August, 2016.

Recommended dose of fertilizer (NPK) 200:300:200 kg ha^{-1} was applied through urea, single super phosphate and muirate of potash. The full dose of P and K and 1/2 dose of N was applied at the time of planting and remaining N 1/2 dose was divided into two splits and first spilt dose was applied at of 45 days of planting and second splits dose of nitrogen was applied at 90 days after planting.

For foliar application of zinc and iron, as per treatments, required concentration of zinc and iron solution was prepared and applied in the form of foliar application at 40, 60 and 80 days after planting. The various observations on growth *viz.,* plant height (cm), number of leaves $clump^{-1}$, leaf area (cm^2) was recorded at 180 days after planting, number of spikes $plant^{-1}$, spikes $plot^{-1}$, spikes ha^{-1}, number of florets $Spike^{-1}$, weight of 10 florets (g) was recorded at harvesting stage. Collected data were analyzed as per the method suggested by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

a) Effect of zinc on Growth parameters

Data from table 1 revealed that, the treatment zinc 0.4% had recorded significantly maximum plant height (59.75 cm), number of leaves $clump^{-1}$(49.18) which was found to be at par with treatment zinc 0.6%. Whereas, minimum height of plant (58.41cm) and number of leaves $clump^{-1}$(48.32) was recorded under the control treatment.

As regards the leaf area, foliar application of zinc 0.4% recorded significantly maximum leaf area (88.96 cm^2) followed by treatments zinc 0.6% (79.55 cm^2) and zinc 0.2% (76.34 cm^2).However, the control treatment recorded minimum leaf area (75.85 cm^2).

Significant increase in the vegetative growth was observed with the increasing levels of zinc up to 0.4 % concentration, however, further increase in concentration had slightly decreased the height. This might be due to zinc at optimum concentration is closely involved in metabolism of RNA and ribosomal content in plant cell which leads to stimulation of carbohydrates, proteins and DNA formation. It also helps in synthesis of tryptophan which acts as a growth promoting substance. The results are closed conformity of the results obtained by Kumar *et al.* (2001). They reported that application of 15 kg Zn ha^{-1} gave the best value for growth parameters in tuberose. Ganesh and Soorianathasundaram (2015) revealed that, foliar application of zinc sulphate 0.5% recorded maximum plant height, number of leaves $clump^{-1}$ and leaf area in tuberose cv. Prajwal.

b) Yield parameters

Significantly maximum number of spikes $plant^{-1}$ (2.32), $plot^{-1}$ (66.72) and ha^{-1}(1.78 lakh) was recorded with the treatment foliar application of zinc 0.4% followed by treatment zinc 0.6%. However, significantly minimum number of spikes $plant^{-1}$ (1.74), $plot^{-1}$ (50.04) and ha^{-1}(1.33 lakh) was recorded in the treatment control. The treatment zinc 0.4% recorded significantly maximum number of florets $spike^{-1}$ (31.57) which was found to be at par with treatments zinc 0.6%. However, minimum number of florets $spike^{-1}$(28.43) was recorded in the treatment control.

As regards weight of ten florets, foliar application of zinc 0.4% had registered significantly maximum weight of ten florets (9.16 g) which was found to be at par with the treatment zinc 0.6% (8.55g). However, minimum weight of ten florets (8.08 g) was noticed under the control treatment.

This might be due to the fact that, zinc activates several enzymes viz., catalyase, tryptophan synthate etc. and involves itself in chlorophyll synthesis and various physiological activities by which plant growth and development are encouraged, due to which the flower yield might have been increased. The findings are in agreement with the findings of Singh and Prasad (2014) in gladiolus. They revealed that maximum number of spikes were recorded with foliar application of zinc sulphate at the rate of 0.4% in gladiolus. Ganesh and Soorianathasundaram (2015) revealed that, foliar application of zinc sulphate 0.5% recorded maximum number of florets $spike^{-1}$, yield of spikes ha^{-1} in tuberose cv. Prajwal.

Effect of iron on Growth parameters

Data from table 1 revealed that foliar application of 0.4% iron recorded significantly maximum plant height (60.10cm), number of leaves $clump^{-1}$ (49.33) and leaf area (93.32 cm^2) followed by treatment iron 0.6% and iron 0.2%. Whereas, minimum plant height (58.30), number of leaves $clump^{-1}$ (48.15) and leaf area (74.23 cm^2) was recorded in control treatment.

Increased in vegetative growth parameters might be due to suitable concentration of iron which acts as important catalyst in the enzymatic reactions of metabolism, and thus, it would have helped in larger biosynthesis of photo assimilates there by enhanced growth of the plant. It also plays an important role in chlorophyll synthesis and respiration. Similar results were also obtained by Ganesh and Soorianathasundaram (2015). They recorded maximum vegetative growth in tuberose by foliar spray of $FeSo_4$ 0.2%. Chopde *et al.* (2015) revealed that, plant height and leaf area were recorded maximum with foliar application of ferrous sulphate 0.4% in gladiolus.

Table 1. Growth and yield of tuberose as influenced by foliar application of zinc and iron

Treatments	Plant height (cm)	Number of leaves $clump^{-1}$	Leaf area (cm^2)	Number of spikes $plant^{-1}$	Number of spikes $plot^{-1}$	Number of spikes ha^{-1}	Number of florets $spike^{-1}$	Weight of 10 florets (g)
Factor A : Zinc								
Control								
(water spray)	58.41	48.32	75.34	1.74	50.04	1.33	28.43	8.08
Zinc 0.2 %	58.63	48.37	76.34	1.79	51.60	1.38	29.26	8.21
Zinc 0.4 %	59.75	49.18	88.96	2.32	66.72	1.78	31.57	9.16
Zinc 0.6 %	58.99	48.73	79.55	1.92	55.37	1.48	30.24	8.55
SE (m) ±	0.31	0.23	1.87	0.06	1.94	0.05	0.66	0.27
CD at 5%	0.90	0.67	5.40	0.19	5.61	0.14	1.93	0.79
Factor B : Iron								
Control								
(water Spray)	58.30	48.15	74.24	1.71	49.13	1.31	27.57	8.02
Iron 0.2 %	58.63	48.40	76.03	1.80	51.84	1.38	29.62	8.15
Iron 0.4 %	60.10	49.33	93.32	2.36	68.04	1.81	32.01	9.33
Iron 0.6 %	59.01	48.72	77.11	1.90	54.72	1.46	30.31	8.51
SE (m) ±	0.31	0.23	1.87	0.06	1.94	0.05	0.66	0.27
CD at 5%	0.90	0.67	5.40	0.19	5.61	0.14	1.93	0.79
Interaction AxB								
SE (m) ±	0.62	0.46	3.74	0.13	3.89	0.10	1.33	0.55
CD at 5%	-	-	-	-	-	-	-	-

Yield parameters

Data from table 1 revealed that, significantly maximum number of spikes plant^{-1} (2.36), plot^{-1} (68.04) and ha^{-1}(1.81 lakh) was harvested from the treatment foliar application of iron 0.4% followed by treatment iron 0.6%. However, significantly minimum number of spikes plant^{-1} (1.71), plot^{-1} (49.13) and ha^{-1}(1.31lakh) was recorded in control treatment.

As regards the number of florets, foliar application of iron 0.4% produced significantly the maximum number of florets spike^{-1}(32.01) which was found to be at par with treatment iron 0.6%. However, minimum number of florets spike^{-1} was recorded with the control treatment (27.57).

Regarding weight of ten florets, foliar application of iron 0.4% recorded significantly maximum weight of ten florets (9.33g) followed by treatment iron 0.6%. Whereas, minimum weight of ten florets (8.02 g) were recorded in control treatment.

This might be due to iron application which enhanced the flowering parameters, relived the plant from chlorosis and produced healthy green leaves which resulted in higher assimilate synthesis and partitioning of flower growth which may in turn increased the flower production and ultimately flower yield. Similar results were also reported by Ganesh and Soorianathasundaram (2015), who reported that, foliar spray of ferrous sulphate 0.2% recorded maximum number of spikes plant^{-1} in tuberose. Chopde *et al*. (2016) revealed that, spikes ha^{-1} recorded maximum with foliar application of ferrous sulphate @ 0.4% in gladiolus. Kakde *et al.* (2009) reported that, ferrous sulphate @ 0.4% significantly recorded number of flowers, weight and yield of flowers in China aster.

Interaction effect

Interaction effect of foliar application of zinc and iron was found non significant in all growth as well as yield parameters of tuberose.

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