Original research article

Effect of foliar application of micronutrients on growth, yield and flower quality of gerbera (*Gerbera jamesonii)* under naturally ventilated polyhouse conditions in Prayagraj

ABSTRACT

A field experiment was executed during November, 2022 to April, 2023 under polyhouse conditions in the Research Field, Department of Horticulture, SHUATS, Prayagraj. The objective was to study the response of foliar application of micronutrients on growth, yield and flower quality of gerbera. The research consisted of three levels of zinc, iron, magnesium (0.2, 0.4, 0.6 %). The experiment was laid out in Randomized Block Design with ten treatments and replicated thrice. The results indicated that the treatment T2-Zn@0.4% performed better in all parameters recorded *viz.*, plant height (24.08 cm), plant spread (37.68 cm), days for first bud initiation (73 days), number of flowers per plant (10), flower diameter (9.67 cm) and vase life (9 days).

Keywords: Micronutrient, Iron, Magnesium, , Zinc, Gerbera, Growth, Yield.

1.INTRODUCTION

Gerbera (*Gerbera jamesonii* Bolus) is an important commercial cut flower grown throughout the world in a wide range of climatic conditions. It belongs to the family Asteraceae. It is commonly known as Transvaal Daisy, Barberton Daisy or African Daisy and this flower is native to South African and Asiatic regions . The world consumption of flowers is estimated to be US dollar 60 billion per annum in which India contribute 0.38 percent only **(Sindhu,2006).** The estimated area under flower cultivation in India is about 0.90 thousand ha with a production of 21.84 cut flowers in lakh number and 4.00 thousand metric tonnes as a loose flower . It ranks fourth in the international cut flower market and a popular cut flower in Holland, Germany and USA **(Choudhary and Prasad, 2000 and Sujatha *et al.*, 2002).** In India, commercial production of gerberas is centred around Pune and Bangalore, parts of Sikkim, Nagaland, Meghalaya and Uttarakhand, from where flowers are being sent to local and international market.

The plant growth and development as well as flower quality is significantly influenced by climatic factors as well as nutrient management. Due to imbalanced use of macro and micro nutrients, the plant growth, development and quality of flower are directly affected. Therefore, balanced nutrient application is necessary for healthy plant growth and production of quality flowers. Micronutrients play vital roles in the growth and development of plants, due to their stimulatory and catalytic effects on metabolic processes and ultimately on flower yield and quality **(Khosa *et al.*, 2011).** These are essential for crop growth and development. Enrichment of crop with micronutrients, especially zinc, iron and magnesium may prove effective in regulating flowering in crops (**Pratap *et al.* 2005)** and aid in flower production.

Zinc is necessary for the synthesis of auxin IAA and for carbohydrate metabolism, protein synthesis (**Shukla *et al.* 2009).** Iron is a key element in different oxidation-reduction reactions of respiration and photosynthesis (**Reddy and Reddi 2002)** and magnesium is involved in chlorophyll synthesis, enzyme activation and protein synthesis. Micronutrients are to be necessarily taken up by the plants from soil or supplemented through foliar application for good growth and yield of crops. Foliar application of nutrients is gaining more importance in fertilization of various field and floricultural crops, in many countries. Foliar fertilization technique may also be a good alternative to the conventional soil application to avoid the loss of fertilizers by leaching. It is recommended by several investigators as an alternative fertilization method to improve the growth and

flowering of gerbera. Keeping these facts in view, this study evaluated the effect of foliar application of Zn, Fe and Mg on growth, flowering and yield of gerbera under protected condition.

2. MATERIALS AND METHODS

An experiment was carried out on "Effect of foliar application of micronutrients on growth, yield and flower quality of gerbera (*Gerbera jamesonii)* under naturally ventilated polyhouse conditions in Prayagraj" at Horticulture Research Field, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj, during 2022-2023.

The experiment was laid out in Randomized Block design with ten treatments and replicated thrice that is, control (T0), ZnSO4 @ 0.2% (T1), ZnSO4 @ 0.4% (T2), ZnSo4 @0.6% (T3), FeSO4 @ 0.2% (T4), FeSO4 @ 0.4% (T5), FeSO4 @ 0.6% (T6), MgSo4 @0.2% (T7), MgSo4 @0.4% (T8) and MgSo4 @0.9% (T9). Healthy tissue cultured plants having 4-6 leaves were planted on flat beds. The planting material were procured from Sheel- Biotech, New-Delhi. They were planted at a spacing of 30 cm x 30 cm. As per treatments the micronutrients were sprayed after one month of planting and subsequently at one-month intervals up to 4 months. Four plants from each replication of a cultivar were used for recording observation. The recommended cultural practices were followed for raising the successful crop. Data on growth, flowering, yield and quality characters was recorded up to 4 months after one month of planting.

3. RESULTS AND DISCUSSION

3.1 Vegetative Parameters

The effect of levels of micronutrients on vegetative parameters of Gerbera are shown in Table 1. From table 1, the application of different levels of Zn, Fe and Mg had produced a significant effect on growth parameters, *viz.* plant height, plant spread, number of leaves. Significantly taller plants (24.08cm) were observed with treatment T2(Zn@0.4%) followed by T5(Fe@0.4%, 22.63 cm) whereas, significantly shorter plants were reported in T0 (Control, 17.69cm). The increase in plant height with application of micronutrient Zn might due to its role in the synthesis of tryptophan which is a precursor of auxin (IAA). Similarly, Fe acts as an important catalyst in enzymatic reactions of metabolism and would have helped in larger biosynthesis of photo assimilates thereby enhancing the growth of plants. Similar results were reported by in **Balakrishnan *et al. (*2007)** in marigold and Pal *et al.,* (2016) in gerbera. Significantly wider plant spread (m^2) (37.68cm) was observed with treatment T2(Zn@0.4%) followed by T5(Fe@0.4% , 35.80 cm) whereas, significantly lesser plant spread (m^2) was reported in T0 (Control, 23.62 cm). The plant spread significantly influenced with application of micronutrient ferrous sulphate is an essential component of several dehydrogenase, proteinase, peptidase and promotes growth hormones and closely associated with plant growth, all these factors contribute to cell multiplication, cell division and cell differentiation resulting in increased photosynthesis and translocation of food material which enhanced the plant spread and zinc sulphate could have attributed to improved root system of plants resulting in absorption of water and nutrients and its utilization. Similar results were also obtained by **Kakade *et al.,* (2009)** in China aster, **Balakrishnan (2007)** in marigold. Significantly more leaves (15.08) were recorded in treatment (Zn@0.4%) followed by T5 (Fe@0.4%, 11.17) and significantly a smaller number of leaves in T0(Control, 7.00). Zinc (Zn) and iron (Fe) are essential micronutrients for plant growth and development including photosynthesis, enzyme activation, and hormone synthesis. Adequate levels of these micronutrients help in promoting leaf growth and increasing leaf number. Similar results were reported by **Khan (2000)** . The statistically analysed data was presented in Table 1.

Table 1. Effect of different levels of micronutrients on vegetative parameters of gerbera

Treatment Symbol	Treatment Combination	Plant height(cm)	Plant spread (cm)	Number of leaves per plant

T_0	**Control**	**17.69**	**23.62**	**7.00**
T_1	**Zn@0.2%**	21.43	33.61	**8.67**
T_2	**Zn@0.4%**	**24.08**	**37.68**	**15.08**
T_3	**Zn@0.6%**	22.55	35.38	**9.67**
T_4	**Fe@0.2%**	22.37	32.43	**7.17**
T_5	**Fe@0.4%**	**22.63**	**35.80**	**9.58**
T_6	**Fe@0.6%**	21.80	35.70	**11.17**
T_7	**Mg@0.2%**	20.39	34.86	**7.83**
T_8	**Mg@0.4%**	18.86	34.50	**7.67**
T_9	**Mg@0.6%**	18.50	26.99	**7.25**
F-Test		**S**	**S**	**S**
S.Ed(±)		**0.43**	**0.85**	**0.55**
C.V.		**2.52**	**3.15**	**7.47**
CD 0.05		**0.90**	**1.79**	**1.16**

3.2 Floral parameters

The effect of levels of micronutrients on floral parameters of Gerbera are shown in Table 2. From table 2, the application of different levels of Zn, Fe and Mg exerted a significant influence on flowering and yield parameters, *viz.* days for first bud initiation, number of flowers/plant, stalk length and vase life .The review of data presented in Table 2 indicated that significantly lesser days (73.25) were taken for first bud initiation in treatment (Zn@0.4%) followed by T5(Fe@0.4%, 85.58) while significantly more number of days taken to first bud initiation T0-Control (106.67). Micronutrients like zinc and iron aids in storage of more carbohydrates through photosynthesis, which may be enhanced to earlier flower bud initiation. Similar results were reported by **Jadhav *et al.* (2005), Sujatha *et al.* (2002)** and **Pimple *et al.* (2006).** Significantly more flowers per plant (10) was found with plants treated with treatment (Zn@0.4%) followed by T5(Fe@0.4%, (9), whereas significantly lower flowers were recorded in T0-Control (6). Application of iron and zinc enhances vegetative growth and healthy green leaves which in turn resulted in higher assimilate synthesis which may increase the flower production and ultimately flower yield. Similar results were obtained by Anuprita et al. (2005) in gerbera and Pal *et al*. (2016). The highest stalk length (56.50 cm) was observed with treatment (Zn@0.4%) followed by T5(Fe@0.4%, 54.17 cm) while lowest was reported in T7(Mg@0.2%, 47.67 cm). The increment in the stalk length might be due to enhanced cell division and cell enlargement. Similar results were reported by **Khan (2000), Sujatha *et al.* (2002) and Gurav *et al.* (2004)** in gerbera. More vase life (8.75) was observed with treatment (Zn@0.4%) followed by T5(Fe@0.4%, 7.68) whereas less vase life was reported in T0(Control, 5.67). The positive impact of micronutrients like zinc, iron and magnesium might be due to the ability of these nutrients in activating several enzymes and their involvement in chlorophyll synthesis and various physiological activities ultimately enhance the vase life. Similar results were reported by **Jadhav *et al.* (2005) and Pal *et al.* (2016).**

Table 2. Effect of different levels of micronutrients on floral parameters of gerbera

Treatment Symbol	Treatment Combination	Days to first bud emergence (Earliness)	Number of Flower/Plant	Stalk length(cm)	Vase life
T_0	**Control**	**106.67**	8	**47.67**	**5.67**
T_1	**Zn@0.2%**	95.17	9	49.25	6.86
T_2	**Zn@0.4%**	**73.25**	**10**	**56.50**	6.33
T_3	**Zn@0.6%**	89.08	8	49.08	**8.75**
T_4	**Fe@0.2%**	87.00	9	49.17	7.22
T_5	**Fe@0.4%**	85.33	**9**	**54.17**	**7.68**
T_6	**Fe@0.6%**	**85.58**	8	50.50	6.89
T_7	**Mg@0.2%**	93.00	6	48.42	6.44
T_8	**Mg@0.4%**	100.42	6	48.58	6.69
T_9	**Mg@0.6%**	98.42	**6**	49.67	6.00
F-Test		**S**	**S**	**S**	**S**
S.Ed(±)		**3.71**	**0.43**	**0.93**	**0.49**
C.V.		**4.97**	**6.74**	**2.26**	**8.76**
CD 0.05		**7.80**	**0.90**	**1.95**	**1.03**

4. CONCLUSION

It is concluded from the present investigation of 10 treatments under study that there was significant variation in all the parameters investigated. The treatment T2-Zn@0.4% reported significantly better performance in parameters like plant height, plant spread, earliness for first bud initiation, number of flowers per plant, stalk length, vase life.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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