

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 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. [As per treatments the micronutrients were sprayed after one month of planting and subsequently at one-month intervals up to 4 months. Data on growth, flowering, yield and quality characters were recorded. The data was analyzed using analysis of variance \(ANOVA\).](#) 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: [Micronutrients](#), [Growth](#), [Yield](#), [Gerbera](#), [Iron](#), [Magnesium](#), [Zinc](#), [Micronutrient](#), [Foliar Gerbera](#), [Zinc](#), [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 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 ([Ministry of agriculture, Govt. of India 2014-15](#)).

The plant growth and development as well as flower quality [is](#) significantly influenced by climatic factors as well as nutrient management [ref/s](#). Due to imbalanced use of macro and micro nutrients, the plant growth, development and quality of flower are directly affected [ref/s](#). Therefore, ~~the~~ balanced nutrient application is necessary for healthy plant growth and production of quality flower. 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 [ref/s](#).

Zinc is necessary for the synthesis of auxin IAA and for carbohydrate metabolism, protein synthesis [ref/s](#). Iron is a key element in different oxidation-reduction reactions of respiration and photosynthesis [ref/s](#) and magnesium [is](#) involved [s](#) in chlorophyll synthesis, enzyme activation and protein synthesis [ref/s](#). Micronutrients

Formatted: Line spacing: 1.5 lines

Formatted: Highlight

Formatted: Highlight

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 [ref/s](#). 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 [ref/s](#). Keeping these facts in view, ~~this study an attempt was made to~~ 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" ~~was carried out~~ at Horticulture Research Field, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj, during 2022-2023.

2.1 Geographical location of the site

Geographically, Prayagraj is situated in the South-Eastern part of Uttar Pradesh. It lies between the parallels of 24° 77' and 25° 47' north latitudes and 81° 19' and 82° 21' east longitudes.

2.2 Experimental Details

The experiment was laid out in Randomized Block design with ten treatments and replicated thrice ~~i.e 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). ~~were selected for this study.~~ 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 were recorded up to 4 months after one month of planting. The data recorded during the experiment ~~was~~ subjected to statistical analysis by using analysis of variance (ANOVA). The significant difference among the varieties were compared against the critical difference at 5% level of significance (CD_{0.05}).

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~~ ~~The results of study revealed that~~ 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 (24.08 cm) 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, 17.69 cm). The increased in plant height with application of micronutrient Zn ~~s~~ might due to its ~~r~~ole in the synthesis of tryptophan which is a precursor of auxin (IAA). ~~Similarly~~ Similarly, ~~Feiron~~ Iron 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~~ ~~observed by in~~ Balakrishnan ~~(et al. (2007)~~ in marigold ~~and~~, Pal- *et al.*, (2016) in gerbera. Significantly wider plant spread (m²) (37.68 cm) was observed with treatment T2(Zn@0.4%) followed by T5(Fe@0.4% , 35.80 cm) whereas, significantly lesser plant spread (m²) was reported in T0 (Control, 23.62 cm). The plant spread significantly influenced with application of micronutrient ferrous

Formatted: Font: Not Bold

sulphate is an essential ~~an essential~~ components 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 ~~be 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 ~~and~~, 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 helps in promoting leaf growth and increasing leaf number. Similar results were ~~observed reported by~~ in 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. The data~~From Table 2, from investigation revealed that 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 ~~to-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). 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~~st- flowers~~ ~~were~~ recorded in T0-Control (~~-6-~~). Application of iron and zinc relieved the plants from chlorosis and produced healthy green leaves which resulted in higher assimilate synthesis which may increase the flower production and ultimately flower yield. Similar results were obtained by 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~~ ~~found in~~ Khan (2000). 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~~ ~~found in~~ Jadhav *et al.*, (2005) and Pal *et al.*, (2016). ~~The statistically analysed data was presented in Table 2.~~

Table 2. Effect of different level 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 ~~showed that there was~~ significant variation in all the parameters ~~observed~~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.

REFERENCES

Abou-Sreea AIB. 2016. Supplying Calendula Plants with Some Micronutrients as Foliar Spray under Egyptian Soils Features. *International Journal of Pharm Tech Research CODEN (USA): IJPRIF*, **12**(9): 97-108.

Formatted: Highlight

Balakrishnan V, Jawaharlal M, Senthil KT and Ganga M. 2007. Response of micro-nutrients on flowering, yield and xanthophyll content in African marigold (*Tagetes erecta* Linn.). *Journal of Ornamental Horticulture*, **10**(3): 153-156.

Basfir AB, Ahmad W, Ahmad KS, Shafi J, Muhammad AS, Muhammad A, Ghani I and Muhammad I. 2013. Efficacy of foliar application of micro nutrients on growth and flowering of Gerbera (*Gerbera jamesonii* Linnaeus) *Universal Journal of Agricultural Research*, **1**(4): 145-149.

Formatted: Highlight

Jadhav AH, Dalal SR, Shinde RD, Deshmukh RP. 2005. Effect of micronutrients on growth and flower production of gerbera under polyhouse conditions. *Advances in Plant Sciences*, **18**(2): 755-758.

Joseph, Ashita, Prasad VM, Vijay B and Samir ET. 2019. Effect of micronutrients on growth, flower quality and yield of China aster (*Callistephus chinensis* Linnaeus) under Allahabad agro climatic condition. *The Pharma Innovation Journal*, **8**(7): 609-613.

Formatted: Highlight

Kakade DK, Rajput SG. and Joshi KL. 2009. Effect of foliar application of Fe and Zn on growth, flowering and Yield of China aster (*Callistepus chinensis* Linnaeus). *Asian Journal of Horticulture*, **4**(1): 138-140.

[Khan \(2000\)](#)

Formatted: Font color: Red, Highlight

Formatted: Font color: Red

Khosa SS, Younis A, Yameen S. and Riaj A. 2011. Effect of foliar application of micro nutrient on growth and flowering of gerbera (*Gerbera jamesonii*) *American-Eurasian Journal of Agriculture and Environmental Sciences*, **11**(5): 736-757.

Kumar PN, Misra R L, Dhiman SR, Ganga M and Lalitha K. 2009. Effect of micronutrient sprays on growth and flowering of chrysanthemum, *Indian Journal Agricultural Sciences*, **79**(6): 426-428.

Formatted: Highlight

[\(Ministry of agriculture, Govt. of India 2014-15\)](#)

Formatted: Font color: Red

Formatted: Highlight

Misra H P. 2001. Response of chrysanthemum to zinc and boron on growth, yield and quality of flowers. *Scientific Horticulture*, **7**: 201-208.

–Mohana M, Sureshkumar R, Sendhilnathan R, Rajkumar M, Barathkumar TR and Karthikeyan PK. 2021. Effect Of Foliar Application of Organic and Micronutrients on Certain Growth and Physiological Character of African Marigold (*Tagetes erecta* L.) Cv. Benz Tall. *Plant Archives*, **21**(1): 2034-2040

Mona YK, Naguib NY and El-Sherbeny SE. 2007. Response of *Tagetes erecta* L. to compost and foliar application of some microelements. *Arab Universities Journal of Agriculture Sciences*, **10**(3): 939-964.

Pal S, Barad AV, Singh AK, Khadda BS. and Kumar D. 2016. Effect of foliar application of Fe and Zn on growth, flowering and yield of gerbera (*Gerbera jamesonii*) under protected condition. *Indian Journal of Agricultural Sciences*, **86**(3): 394-398.

Pirzad, Alireza, and Fahime S. 2012. Effects of iron application on growth characters and flower yield of *Calendula officinalis* L. under water stress. *World Applied Sciences Journal*, **18**(9): 1203-1208.

Pradhan, Sumita, and Mitra M. 2020. Effect of Micronutrients on Growth and Flowering of Marigold cv. Siracole. *Agricultural Science Digest-A Research Journal*, **40**(1): 53-56.

[Pratap et al., 2005](#)

Sahu MK, Tirkey T, Gaurav S. and Agrawal R. 2016. Effect of foliar application of micronutrients on nutrient content of gerbera (*Gerbera jamesonii* Bolus ex. Hook). *Journal of Ornamental Horticulture*, **19**(1): 30-33.

Singh S, Deepanshu and Fatmi U. 2019. Effect of micro-nutrients on plant growth and flower yield of calendula (*Calendula officinalis* L.) cv. Doppio under Prayagraj agro-climatic condition. *The Pharma Innovation Journal*, **8**(7): 137-140.

Soni SS. and Godara AK. 2015. Effect of foliar application of borax, FeSO₄ and MnSO₄ on vegetative growth and flower production in gerbera. *Research in Environment and Life Sciences*, **8**(4): 581-584.

Swarnima and Saravanan SS. 2020. Effect of micro nutrients on plant growth and flower yield of calendula (*Calendula officinalis* L.) var. Bon Bon. *Journal of Pharmacognosy and Phytochemistry*, **9**(6): 874-876.

Swetha B, Zehra S, Prasanth P, Kaladhar K, Babu and Gouthami P. 2022. "Studies on the effect of micronutrients on growth and quality in gaillardia (*Gaillardia pulchella* Foug)." *Pharma Innovation*, **11**(12):2337-2341.

Formatted: Highlight

Formatted: Font color: Red

Formatted: Highlight

UNDER PEER REVIEW