Environment and Ecology 42 (4B) : 1967—1971, October—December 2024
Article DOI: https://doi.org/10.60151/envec/SHCU8008
ISSN 0970-0420

Influence of Various Concentrations of Iron on Growth and Corm Yield in Gladiolus cv Malaviya Kiran

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Received 19 June 2024, Accepted 20 November 2024, Published on 16 December 2024

ABSTRACT

The present investigation was carried out at Horticulture Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India during 2022-2023. The experiment was laid out using Randomized Block Design (RBD) with 11 treatments and 4 replications. The different concentrations of $FeSO_4$ treatments used in gladiolus plants were control (distilled water), $FeSO_4$ 0.1%, $FeSO_4$ 0.2%, $FeSO_4$ 0.3%, $FeSO_4$ 0.4%, $FeSO_4$ 0.5%, $FeSO_4$ 0.6%, $FeSO_4$ 0.7%, $FeSO_4$ 0.8%, $FeSO_4$ 0.9% and $FeSO_4$ 1.0%. Foliar application of iron was done at 3rd and 6th leaf stage. Growth characters observed the best results with application of $FeSO_4$ 0.3%. Number of plants/hill (2.19), number of leaves/hill (9.69), leaf length (55.88) and leaf width (2.52 cm) resulted maximum with the treatment of $FeSO_4$ 0.3%. Whereas, the longest plant height (59.21 cm) and widest scape width (2.59 cm) was recorded with $FeSO_4$ 0.2% and $FeSO_4$ 0.6%, respectively. Similarly, yield parameters such as number of corms/hill (2.23), weight of corms/hill (38.49 g) was recorded maximum with the treatment $FeSO_4$ 0.3%. While, the maximum number of cormels/hill, weight of cormels/hill and weight of cormels was noted with the treatment of $FeSO_4$ 0.2% (14.32 g, 5.87 g and 0.41 g, respectively).

Keywords Gladiolus, Ferrous sulfate, Growth, Corm, Cormel, Yield.

INTRODUCTION

Gladiolus (*Gladiolus* spp. L.), often known as sword lily, is a member of the Iridaceae family and is considered to be the most popular flower in the world from the commercial aspect. It is regarded as the "Queen of the bulbous flowers" and has a high economic value as cut flower. Gladiolus is a potential flower crop for floriculture industry and it is commercially grown in several states of India (Singh 2014). The majestic spike of the gladiolus holds a huge number of gorgeous, graceful florets. Gladiolus was introduced into cultivation towards the end of the

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sixteenth century. The flowers are utilized in floral arrangements, bouquets and for indoor decorations. In India, gladiolus is cultivated commercially in states such as West Bengal, Maharashtra, Uttar Pradesh, Uttarakhand, Punjab, Haryana, Sikkim, Jammu and Kashmir, Karnataka, Gujarat, Himachal Pradesh, Tamil Nadu, Madhya Pradesh, Delhi and Rajasthan (Singh and Sisodia 2017). Fertilizers are essential for gladiolus growth, quality, corm and cormel production, just as they are required for other crops. Healthy vegetative growth is essential for the production of superior flowers and plants. The quantity and accessibility of both macro and micronutrients in the soil significantly influence plant growth. The role of micronutrients is particularly critical in gladiolus cultivation, while macro nutrients are essential for overall growth and development.

Micro nutrients such as zinc, boron and iron have a significant effect on plant growth and development. Chemical fertilizers, particularly micronutrients, are not advised for quality corm and cormels production by the producers. Even flower growers are able to increase their corms without use of chemical fertilizers. As a result, they are unable to obtain the largest corms and cormels for flower cultivation. That is why application of micronutrients is beneficial for increasing corms and cormels production. Iron being an important micronutrient, functions as a catalyst in promoting a various type of reactions. It includes cytochrome, which is involved in the electron transport chain and plays a key role in respiration and as an oxygen carrier. Foliar application of micronutrients is a superior option for plants to utilize those nutrients that are not easily present in soil. It is one of the effective ways to provide nutrients to the plants. This implies that iron can help in promoting growth and corm yield in gladiolus. Beneficial effect of application of iron was observed by Singh *et al.* (2016) in gladiolus. As a result of the given context and reason, a field study was conducted to investigate the influence of various concentrations of iron on growth and corm yield in gladiolus cv Malaviya Kiran.

MATERIALS AND METHODS

The field investigation was laid out at Horticulture Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India in winter season during year 2020-2021. The experiment was performed by using Randomized Block Design (RBD). Farmyard manure and N, P, K was applied as recommended. The diseases and insect infestation free corms of gladiolus of variety Malaviya Kiran were obtained from Department Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India and were planted at a spacing of 30 cm × 20 cm and depth of 6 cm. There were 44 plots with 11 treatments and 4 replications. Iron treatment was used in the form of ferrous sulfate. Lime was used to neutralize the ferrous sulfate. The 11 treatments which were used are Control (distilled water), $FeSO_4$ 0.1%, $FeSO_4$ 0.2%, $FeSO_4$ 0.3%, $FeSO_4$ 0.4%, $FeSO_4$ 0.5%, $FeSO_4$ 0.6%, $FeSO_4$ 0.7%, $FeSO_4$ 0.8%, $FeSO_4$ 0.9% and $FeSO_4$ 1.0%. Foliar application of iron was done at 3rd and 6th leaf stage by using hand sprayer. Intercultural operations like earthing up, weeding, hoeing, irrigation and plant protection was done when required. Different growth parameters such as number of plants/hill, number of leaves/hill, leaf length, leaf width and scape width were recorded at 60 days after planting. Corm parameters i.e., number of corms/hill, weight of corms/hill, number of cormels/hill, weight of cormels/hill, weight of cormels and diameter of corm were recorded and analyzed statistically.

RESULTS AND DISCUSSION

Growth parameters

Growth parameters in gladiolus at 60 days after planting was significantly influenced by different iron treatments (Table 1). Number of plants/hill is an important growth parameter which is responsible for the optimum yield. Maximum number of plants/hill was observed in the plants treated with $FeSO_4$ 0.3% (2.19) which was at par with the treatments of $FeSO_4$ 0.2% (2.13), control (1.94) and $FeSO_4$ 0.8% (1.75). Iron being an essential micronutrient plays a vital role in growth of plants and is related with cell division and multiplication. This may be the reason for increased number of plants/hill. Number of leaves/hill was noted maximum with the treatment of $FeSO_4$ 0.3% (9.69), which was statistically at par with $FeSO_4$

Table 1. Influence of various concentrations of iron on growth parameters in gladiolus cv Malaviya Kiran.

Treatment	Number of plants/hill	Number of leaves/hill	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Scape width (cm)
Control (Distilled water)	1.94	8.38	57.23	44.36	2.30	1.49
$FeSO_4$ 0.1%	1.69	8.44	56.46	52.93	2.35	1.50
$FeSO_4$ 0.2%	2.13	8.44	59.21	52.53	2.47	1.86
$FeSO_4$ 0.3%	2.19	9.69	55.88	55.88	2.52	1.95
$FeSO_4$ 0.4%	1.63	8.31	57.49	52.01	2.29	1.98
$FeSO_4$ 0.5%	1.25	6.13	48.92	48.92	2.26	1.99
$FeSO_4$ 0.6%	1.25	6.56	58.26	53.71	2.18	2.18
$FeSO_4$ 0.7%	1.25	6.44	54.00	49.16	2.14	2.00
$FeSO_4$ 0.8%	1.75	8.00	55.27	51.21	1.93	1.81
$FeSO_4$ 0.9%	1.25	6.06	54.51	51.87	1.72	1.41
$FeSO_4$ 1.0%	1.38	5.44	48.38	43.96	1.39	1.26
CD at 5%	0.48	1.64	5.42	5.55	0.31	0.26

0.2% (8.44), $FeSO_4$ 0.1% (8.44), control (8.38) and $FeSO_4$ 0.4% (8.31). These results are in conformity with the observations made by Soni and Godara (2015) in gerbera and Singh *et al.* (2024) in gladiolus. Whereas, maximum plant height was achieved with the treatment of $FeSO_4$ 0.2% (59.21 cm). The involvement of these micronutrients in chlorophyll synthesis and other physiological processes by activating several enzymes might be the reason for iron treatments having different effects on plant height. This finding was in accordance to the investigation reported by Chopde *et al*. (2015), Singh *et al*. (2017) in lilium, Kolukunde *et al*. (2014) in gerbera, Verma *et al.* (2018) in China aster and Hussain *et al.* (2020) in marigold and Singh *et al*. (2024) in gladiolus. Leaf length (55.88) and leaf width (2.52 cm) was recorded maximum with the treatment of $FeSO_4$ 0.3%. By lowering ethylene and abscisic acid levels, iron plays an important role in protein synthesis, respiration, photosynthesis and floral growth which helped in the increment of leaf length and leaf width. This finding was in compliance with the observations made by Singh *et al.* (2024) in gladiolus. Scape width was found to be maximum (2.18 cm) in the plants treated with $FeSO_4$ 0.6% which was statistically at par with the treatments of $FeSO_4$ 0.7% (2.00 cm), $FeSO_4$ 0.5% (1.99 cm), $FeSO_4$ 0.4% (1.98 cm) and $FeSO_4$ 0.3% (1.95 cm). This could be because iron is linked to cell multiplication, cell division and cell differentiation, all of which resulted in increased photosynthesis and nutrient observation. These results are in agreement with the observations made by Pal *et al.* (2016) in gerbera and Hembrom and Singh (2015) in lilium.

Table 2. Influence of various concentrations of iron on cormyield in gladiolus cv Malaviya Kiran.

Treatment	Number of corms/hill	Weight of corms/hill (g)	Number of cormels/hill	Weight of cormels/hill (g)	Weight of cormels (g)	Diameter of corm (mm)
Control (Distilled water)	1.94	28.06	7.90	1.98	0.25	41.10
$FeSO_4$ 0.1%	1.69	28.44	9.23	2.68	0.29	42.11
$FeSO_4$ 0.2%	2.13	36.84	14.32	5.87	0.41	42.89
$FeSO_4$ 0.3%	2.23	39.48	7.63	1.91	0.25	48.21
$FeSO_4$ 0.4%	1.63	37.29	11.21	4.37	0.39	44.70
$FeSO_4$ 0.5%	1.25	26.46	8.54	2.39	0.28	41.38
$FeSO_4$ 0.6%	1.35	29.50	6.79	1.56	0.23	41.56
$FeSO_4$ 0.7%	1.25	34.26	5.96	1.37	0.23	44.96
$FeSO_4$ 0.8%	1.75	22.68	9.24	3.23	0.35	35.18
$FeSO_4$ 0.9%	1.25	23.63	8.34	2.26	0.27	40.76
$FeSO_4$ 1.0%	1.38	16.33	8.33	2.17	0.26	36.38
CD at 5%	0.38	8.78	4.28	0.87	0.10	6.94

Yield parameters

Yield parameters in gladiolus is strongly affected by various iron treatments (Table 2). Number of corms/hill determines the optimum yield in gladiolus. Number of corms/hill was increased with the treatment of $FeSO_4$ 0.3% (2.23). The foliar application of iron led to increased vegetative and reproductive growth which eventually increased the number of corms/hill. Current finding is in lent credence to the investigation made by Singh *et al.* (2024) in gladiolus variety Malaviya Shatabdi. Weight of corms/hill was increased significantly by application of iron treatments. It was found to be maximum in the plants treated with $FeSO_4$ 0.3% (39.48 g), which was statistically at par with the plants treated with $FeSO_4$ 0.4% (37.29 g), $FeSO_4$ 0.2% (36.84 g) and $FeSO_4$ 0.7% (34.26 g). Similarly, number of cormels/hill, weight of cormels/hill and weight of cormels was noted maximum with the treatment of $FeSO_4$ 0.2% (14.32 g, 5.87 g and 0.41 g, respectively). This could be because iron increases cell size and promotes vegetative growth, causing available food material to be translocated to the corms, resulting in an increase in number and weight of corms and cormels. The similar results were obtained in the research findings observed by Singh *et al.* (2024) in gladiolus. Whereas, the maximum diameter of corm was found with the treatment of $FeSO_4$ 0.4% (48.21 mm), which was statistically at par with the treatments of $FeSO_4$ 0.7% (44.96 mm), $FeSO_4$ 0.3% (44.70 mm), $FeSO_4$ 0.2% (42.89 mm), $FeSO_4$ 0.1% (42.11 mm), $FeSO_4$ 0.6% (41.56 mm) and $FeSO_4$ 0.5% (41.38 mm). This could be due to accumulation of proteins in corms and cormels, which is caused mostly by micronutrients. Similar results were also achieved by Singh *et al*. (2024), Chopde *et al.* (2015) in gladiolus and Hembrom *et al.* (2017) in lilium.

CONCLUSION

From the above study it is observed that the plants treated with 0.3% $FeSO_4$ achieved the best results in growth parameters. Whereas, application of $FeSO_4$ at 0.2% showed the best results in yield parameters. Hence, it is concluded that foliar application of $FeSO_4$ at 0.3% and 0.2% is beneficial for growth and yield parameters, respectively.

ACKNOWLEDGMENT

The authors gratefully acknowledge the support and facilities provided by the Institute of Agricultural Sciences at BHU, Varanasi, as well as the assistance from the Department of Horticulture (Floriculture and Landscaping) Institute of Agricultural Sciences at BHU, Varanasi.

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