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Effect of Different Level of Micronutrients on Growth, Flowering and Corm Yield of Gladiolus cv. Malaviya Shatabdi

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ABSTRACT: An investigation was carried out to evaluate the effect of different levels of micronutrients on the growth, flowering and corm yield of gladiolus (*Gladiolus* spp.) cv. Malaviya Shatabdi. The experiment was conducted at Horticulture Research Farm, Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, during 2023-24 season. Treatments include a control (distilled water) and varying levels of Fe and B, applied as foliar sprays at 3rd and 6th leaf stage. The results demonstrated that the combined application of 0.2% B + 0.4% Fe significantly improved plant growth, flowering characters and yield parameters. This treatment produced the highest number of leaves per plant (16.04), and maximum leaf width (2.73 cm), widest scape (2.54 cm) whereas, flowering parameters showed promising results at application of 0.2 % B + 0.4 % Fe for days to colour show, days to opening of 3rd and 5th floret, diameter of 3rd and 5th floret, length of 3rd and 5th floret, number of opened florets per spike (9.27) rachis length (44.18 cm) and internodal length (4.87). Similarly, corm production was also significantly influenced by Fe and B applications. The highest number of cormels per hill (9.60) and maximum weight of corm per hill (46.75 g). These findings suggest that foliar application of 0.2% B + 0.4% Fe optimizes vegetative growth, floral characteristics and corm yield in gladiolus cv. Malaviya Shatabdi.

Keywords: Foliar spray, gladiolus corms, micro nutrient, growth, flowering, corm yield.

INTRODUCTION

Gladiolus (*Gladiolus grandiflorus* L.), commonly referred to as "Glad" is a well-known bulbous cut flower plant that originated in South Africa. It is a member of the Iridaceae and sub-family Ixiodaeac. Because of its sword-shaped leaves, gladiolus is also known as the Corn Lily or Sword Lily. Being a significant bulbous decorative plant, it holds a prominent place among commercial flower harvests and is much sought after in both domestic and foreign markets (Ahmad *et al*., 2010). Iron acts as activation for several biochemical processes such as respiration, photosynthesis and symbiotic nitrogen fixation. These results validate the substantial role of iron accumulation of photo assimilates for growth and development of plants (Singh *et al*., 2017). Whereas, boron plays a crucial role in ensuring normal plant growth (Shireen *et al*., 2018). This micronutrient is required in trace amounts to support optimal growth, development and metabolic activities in plants (Gowthami *et al*., 2022). In the case of cut flowers, boron is particularly important for enhancing shelf life, ensuring their longevity and marketability. Additionally, genetic variability exists among different plant genotypes, leading to variations in growth patterns and adaptability (Swaroop *et al*., 2019).

In the Varanasi region, the application of iron (Fe) and boron (B) in gladiolus cultivation is essential due to their critical roles in plant growth and flower quality. Iron is vital for chlorophyll synthesis, enhancing photosynthesis and improving flower yield, while boron supports cell wall formation, pollen germination and nutrient transport, leading to better spike and floret development. The alluvial soils of Varanasi often exhibit micronutrient deficiencies, particularly Fe and B, necessitating their supplementation to maximize gladiolus production (Singh *et al*., 2017 and 2024).

MATERIALS AND METHODS

The field experiment was conducted during the winter season of 2023-24 at the Horticulture Research Farm, Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India, using a Randomized Block Design (RBD). Disease free corms of gladiolus cv. Malaviya Shatabdi were planted at a spacing of 30 cm × 20 cm at a depth of 8-10 cm in well prepared field incorporated with farmyard manure and NPK fertilizers applied as per recommendations. The study included eight treatments with three replications. Iron ($FeSO_4$) and boron (boric acid) were applied *via* foliar spray at 3rd and 6th leaf stage with treatments comprising control (distilled water), 0.2% B, 0.4% B, 0.2% Fe, 0.4% Fe, 0.2% B + 0.2% Fe, 0.2% B + 0.4% Fe and 0.4% B + 0.4% Fe. All the growth flowering and corm parameters were recorded and analysed statistically.

RESULTS AND DISCUSSION

Growth parameters: Maximum number of leaves per hill (15.81), leaf width (2.73 cm) and scape width (2.54 cm) were recorded in plants treated with 0.2% B + 0.4% Fe treatment, which was statistically similar to the 0.2% B + 0.2% Fe, 0.4% B + 0.4% Fe and 0.4% Fe treatments but showed significant differences when compared to the other treatments. These findings align with the previous work of Soni and Godara (2015) in gerbera and Singh *et al*. (2012 and 2024) in gladiolus. Micronutrients play a crucial role in plant growth by facilitating key processes such as cell division, multiplication and differentiation, which contribute to enhanced photosynthesis and efficient nutrient transport. The observed increase in scape width can be attributed to these micronutrient-induced physiological improvements. Various growth parameters that have been influenced by different levels of iron and boron has been presented in Table 1. The vegetative attributes like number of leaves/hills, leaf width, scape width was significantly influenced due to the treatments. Increase in number of leaves may be due to transport of starch and sugars by boron affecting physiological processes, these findings supported to those of Singh *et al*. (2018 and 2024); Somkuwar *et al*. (2023) in gladiolus. Whereas, increase in leaf width and scape width with treatment 0.2 % B + 0.2% Fe is due to accumulation of boron and iron in leaf tissues causing cell elongation. Also, cell wall synthesis and stability increase with components of cell wall like pectins, polyols and polyhydroxyl polymers.

Flowering Characters: Present study revealed that iron and boron treatments played a significant role in determining the various flowering parameters (Tabel 1 and 2; Fig. 1). Plants treated with 0.2% B + 0.4% Fe exhibited the earliest onset of flower colouration (89.93 days), likely due to the promotion of reproductive growth through optimal micronutrient application. These findings are in agreement with Singh *et al*. (2016 and 2024); Somkuwar *et al*. (2023) in gladiolus crop. The earliest floret opening with 0.2 % B + 0.4 % Fe treatment, may be attributed to iron's role in regulating plant hormone levels, promoting early maturation and floret development. Similar effects were observed in marigold by Kumar *et al*. (2010) following foliar iron application and in gladiolus by Memon *et al*. (2013).

Whereas, increase in floret diameter and length is due to the reason that iron and boron play a vital role in promoting vegetative growth, which subsequently enhances flowering and may contribute to an increase in floret diameter. Similar results were reported by Bhandari *et al*. (2022) in calendula, Chopde *et al*. (2016) in annual chrysanthemum, Balkrishnan *et al*. (2007) in marigold and Verma *et al*. (2018) in China aster.

Iron and boron are being essential elements for plant growth, as they enhance carbohydrate accumulation by stimulating photosynthesis, which may contribute to floret elongation. These findings are in line with the research of Chopde *et al*. (2015) in tuberose. Additionally, research findings demonstrate that rachis length (43.60 cm) and internodal length (3.65 cm) were significantly influenced by different iron treatments.

Table 1: Effects of different concentrations of iron and boron on growth and flowering attributes in gladiolus cv. Malaviya Shatabdi.

Treatment	Number of leaves/hills	Leaf width (cm)	Scape width (cm)	Floret diameter (cm)		Floret length (cm)	
				3rd floret	5th floret	3rd floret	5th floret
Control (Distilled water)	12.55	2.07	1.90	6.96	6.70	8.70	8.40
0.2 % B	13.16	2.24	2.14	7.23	6.90	9.23	8.53
0.4 % B	13.54	2.27	2.19	7.16	7.13	9.33	9.00
0.2 % Fe	14.50	2.45	2.28	7.26	7.03	9.90	9.03
0.4 % Fe	14.97	2.60	2.37	8.03	7.70	9.93	9.23
0.2 % B + 0.2 % Fe	15.81	2.66	2.48	8.13	8.19	10.00	9.80
0.2 % B +0.4 % Fe	16.04	2.73	2.54	8.23	8.20	10.13	10.00
0.4 % B + 0.4 % Fe	15.78	2.62	2.40	8.03	7.73	9.96	9.46
C.D. at 5%	1.59	0.23	0.20	0.30	0.46	0.44	0.42

Similar observations have been reported by Chopde *et al*. (2015); Somkuwar *et al*. (2023) in gladiolus.

A significant variation in opened florets per spike can be attributed to the essential role of iron in promoting the growth and development of gladiolus plants, along with its stimulatory and catalytic influence on flower yield and metabolic processes. These results align with the findings of Mishra *et al*. (2018); Kashyap and Tikey (2020) in gladiolus, Hajizadeh *et al*. (2019) in gerbera.

Corm and cormel parameters: The study demonstrated a significant impact on number and weight of cormels per hill. The highest cormel count (9.60) and weight (46.75 g) were recorded in plants treated with 0.2 % B + 0.4 % Fe. This increase could be attributed to the application of iron and boron, which stimulated vegetative and reproductive growth, leading to higher cormel production. These results align with the findings of Kashyap and Tikey (2020); Yashawanth *et al*. (2016); Pratap *et al*. (2005); Somkuwar *et al*. (2023); Singh *et al*. (2024) in gladiolus.

The treatment also had a significant effect on corm weight per hill, that can be attributed to iron's role in promoting cell enlargement and boosting vegetative growth, which facilitates nutrient transfer to the corms, ultimately increasing their weight. Similar results were reported by Chen *et al*. (1982); Yashawanth *et al*. (2016) in gladiolus.

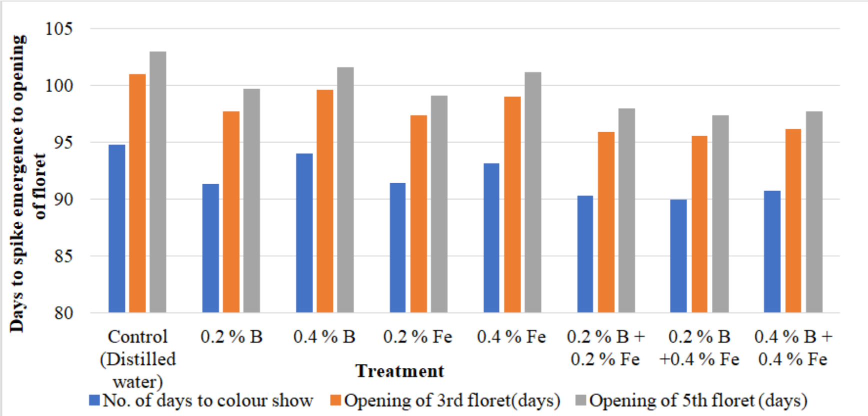

Fig. 1. Effect of iron and boron on colour show and opening of 3rd and 5th floret in gladiolus cv. Malaviya Shatabdi.

Table 2: Effects of different iron and boron on flowering and corm parameters in gladiolus cv. Malaviya Shatabdi.

Treatment	No. of open florets/spike	Rachis length (cm)	Inter nodal length (cm)	Number of cormels/hill	Weight of corms/hill (g)
Control (Distilled water)	7.88	38.00	2.66	4.30	39.50
0.2 % B	6.96	40.53	3.21	4.82	41.31
0.4 % B	8.24	41.23	3.38	5.53	42.28
0.2 % Fe	8.36	41.76	3.41	6.31	43.18
0.4 % Fe	8.40	42.60	3.25	7.48	44.26
0.2 % B + 0.2 % Fe	8.87	43.60	3.56	9.03	45.40
0.2 % B +0.4 % Fe	9.21	42.16	3.65	9.60	46.75
0.4 % B + 0.4 % Fe	8.71	1.99	3.55	8.35	44.92
C.D. at 5%	1.11	37.90	0.38	2.54	2.46

CONCLUSIONS

This study highlights that the foliar application of 0.2% B + 0.4% Fe significantly enhances plant growth parameters, flowering characters and as well as corm and cormel yield in gladiolus cv. Malaviya Shatabdi. The results confirm that this treatment is the most effective for improving vegetative development and reproductive yield. Thus, it can be concluded that applying 0.2% B + 0.4% Fe is the optimal strategy for maximizing growth and yield in gladiolus cultivation.

FUTURE SCOPE

Evaluation of the long-term effects of repeated foliar treatments of Fe and B on soil health and gladiolus productivity can be the main focus of this research. Micronutrient recommendations could be standardized with the aid of comparative studies across various gladiolus cultivars and agroclimatic areas.

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