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Effect of micronutrients (Zn, B and Fe) in growth, and corms yields of gladiolus (*Gladiolus grandiflorus* L.)

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Abstract
Field trial of growth and corms production of gladiolus was carried out at Floriculture field of KNK College of Horticulture Mandsaur Madhya Pradesh during rabi seasons of 2017-2018 respectively. The objectives were to evaluate the response of $ZnSo_4$, $FeSo_4$ and B on growth and corms production and to find out the optimum dose of $ZnSo_4$, $FeSo_4$ and B for maximizing growth and corms Yiels for Gladiolus cultivation. Treatments comprising each three levels of Zn (0, 1%, and 2%), FeSo4 (0, 0.5% and 1%), and three levels of B (0, 0.02% and 0.04%) were spray at 45 DAP. The results revealed that foliar application of $ZnSO_4$ 2% + $FeSO_4$ 1% + B 0.04% (T_9) recorded significantly maximum growth and yield parameters in respect of width of longest leaf (cm), length of longest leaf (cm),number of corms/ hill, Weigth of corms per hill (g), number of cormels/hill, Weigth of cormels per hill (g) However T_8 ($ZnSO_4$ 2% + $FeSO_4$ 1% + B 0.02%) was found to be significant *viz.*, Plant height (cm) and diameter of corms (cm).

Keywords: Zinc Sulphate, ferrous Sulphate, boron, micronutrient, gladiolus, Mayur

1. Introduction
Gladiolus (*Gladiolus spp.*), generally called "Glad", a member of family Iridaceae and sub-family Ixiodeae, Its chromosome number is 2n = 30. is a prominent bulbous cut flower plant. It is also known as the Sword Lily, due to its sword shaped leaves, or Corn Lily. The genus *Gladiolus* consists of about 260 species among which 10 species are native to Eurasia and 250 belong to sub-Saharan Africa (Goldblatt and Manning, 1998; Manning and Goldblatt, 2008) [4]. Gladiolus is frequently used as cut flower on different social and religious ceremonies. It is also used as bedding flower, herbaceous border or does quite well in pots (Bose and Yadav, 1989). Gladiolus with its beautiful spikes, produces flowers from October to March in the plains and from June to September in the hills of India.

The name gladiolus was originally coined by Pliny the Elder (A.D.23-79). The major gladiolus growing areas of India are Kalimpong (W.B.), New Delhi, Srinagar (J & k) and Bhawali (Nanital).

In Kalimpong, the crop is mainly grown for the production of corms/cormels on a commercial scale. The spikes obtained are sold in Culcutta. Optimum growth of gladiolus occurs at temperature between 10-25 ºC. All types of soil are suitable for growing gladiolus flowers but mainly sandy loam soil is preferred. Soil pH between 6.0 to 7.0 is ideal.

Gladiolus is highly responsive to chemical fertilizers. The requirement of fertilizers like other crops has vital role in growth, quality of flowers, corm and cormel production. The plant growth and development is greatly affected by zinc, boron, iron etc. (Singh *et al*., 2012) [14]. Zinc is essential for carbon dioxide evolution, utilization of carbohydrate, phosphorus metabolism and synthesis of RNA.

Boron plays a key role in a diverse range of plant functions including cell wall formation and stability, maintenance of structural and functional integrity of biological membranes, movement of sugar or energy into growing parts of plants, and pollination and seed set. Adequate B is also required for effective nitrogen fixation. Iron acts as catalyst in formation of chlorophyll and several enzymes. It is an important element in various reactions of respiration, photosynthesis and reduction of nitrate and sulphate (Singh *et al.*, 2012) [14].

2. Materials and Methods

The field study on Zn, Fe and B was carried out at Floricultural Research field at K.N.K. College of Horticulture, Mandsaur (M.P.) during rabi seasons of October 2017 to April 2018 respectively. Mandsaur is situated in Malwa plateau of Madhya Pradesh. The objective was to evaluated the response of growth and corm's to zinc, boron and iron and their optimum requirement for growth and corm production. The fertility status of analyzed soil samples before fertilization. The nutrient status of native soil was found to be almost below critical level. There were nine treatment combination comprising each three levels of Zn (0, 1% and 2%), three levels of Fe (0, 0.5% and 1%) and three levels of B (0, 0.02% and 0.04%) were taken in the study. The treatments were randomized for getting equal chance in respect of fertility. The experiment was laid out in Randomized Block Design. The corms of uniforms shape and size were selected for planting of corms planting was done on 16 November 2017 at planting distance of 30 × 30cm and corms were planted about 5 cm deep. Irrigation, hoeing, weeding, earthing up and staking operations were completed according to needs. The observations on each treatment were recorded and analysed statistically on the growth and corms characters.

Table 1: Effect of micronutrients on Growth, and Corms yields of gladiolus

Treatment	Plant height (cm)	Width of longest leaf (cm)	Length of longest leaf (cm)	Number of corms/ hill
(T_1)	77.67	2.73	55.87	1.40
(T_2)	82.07	2.83	59.93	1.67
(T_3)	79.87	2.93	59.20	1.80
(T_4)	82.93	3.03	59.07	1.60
(T_5)	84.13	3.05	60.93	1.53
(T_6)	83.33	2.97	58.40	2.20
(T_7)	85.47	3.06	60.47	1.60
(T_8)	89.27	3.07	59.67	2.27
(T_9)	85.88	3.11	61.47	2.30
CD (5%)	8.623	0.15	2.11	0.61
S.E m.	2.876	0.053	0.704	0.204

Table 2: Effect of micronutrients on Growth, and Corms yields of gladiolus

Treatment	Weight of corms/ hill (g)	Number of cormels/ hill	Weight of cormels/ hill (g)	Diameter of corm (cm.)
(T_1)	34.65	4.13	0.56	4.09
(T_2)	47.30	6.00	0.85	4.45
(T_3)	43.29	6.13	0.90	4.33
(T_4)	43.33	5.13	0.71	4.29
(T_5)	40.03	5.00	0.73	4.64
(T_6)	46.79	5.80	0.85	4.25
(T_7)	41.93	7.33	1.11	4.71
(T_8)	61.79	8.95	1.32	4.73
(T_9)	65.43	10.60	1.70	4.49
CD (5%)	18.08	1.65	0.28	0.38
S.E m.	6.031	0.552	0.096	0.130

3. Result and Discussion

3.1 Plant height

Statistical analysis of the data on plant height revealed non-significant differences among the micronutrients treatments. The maximum plant height was recorded in T_8 (89.27cm)) which was statically similar to T_9 (85.88cm), T_7 (85.47cm) and T_5 (84.13cm.) and significant to other treatments. While the minimum plant height (77.67) was recorded by under control. Similar findings have been reported by Muthumanickam *et al.*, (1999) [6], in gerbera and Rao (2005) [8] in gladiolus. The might be due to $FeSO_4$ and $ZnSO_4$ Play major role in synthesis of tryptophan, which is precursor of auxin (IAA) and it, is an essential for nitrogen metabolism which stimulates growth in the plants. (Chopde *et al.* 2015 in gladiolus) [3].

3.2 Width of longest leaf (cm)

The data presented in table envisaged that the width of longest leaf (cm) differed significantly among the different treatment. Treatments under study were given same conditions but variations were there. Maximum leaf width was recorded with T_9 (3.11 cm) followed by T8 (3.07cm) both were statistically similar and significant to other treatments. Minimum width of leaf was recorded with T_1 (control) (2.73 cm).The findings of foliar application of zinc by Bala *et al.* (2007) [1] and Reddy and Chaturvedi (2009) [9] in gladiolus. Increase in leaf width with increase concentration of zinc might be due to increased intensity of auxin (IAA) which promotes growth by cell division and cell elongation (Reddy and Rao 2012) [8].

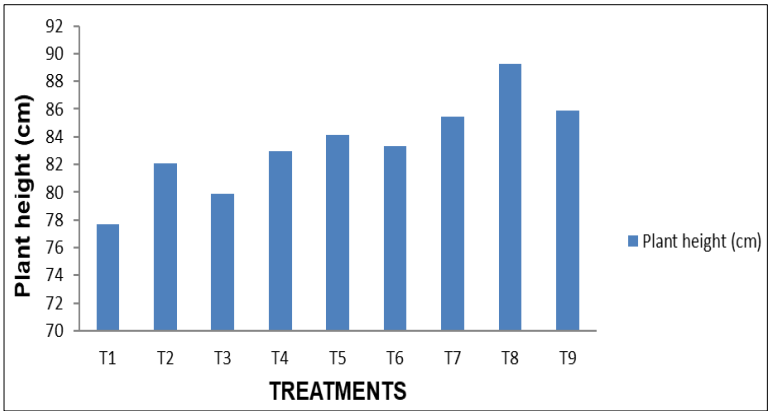

Fig 1: Effect of micronutrients on plant height (cm)

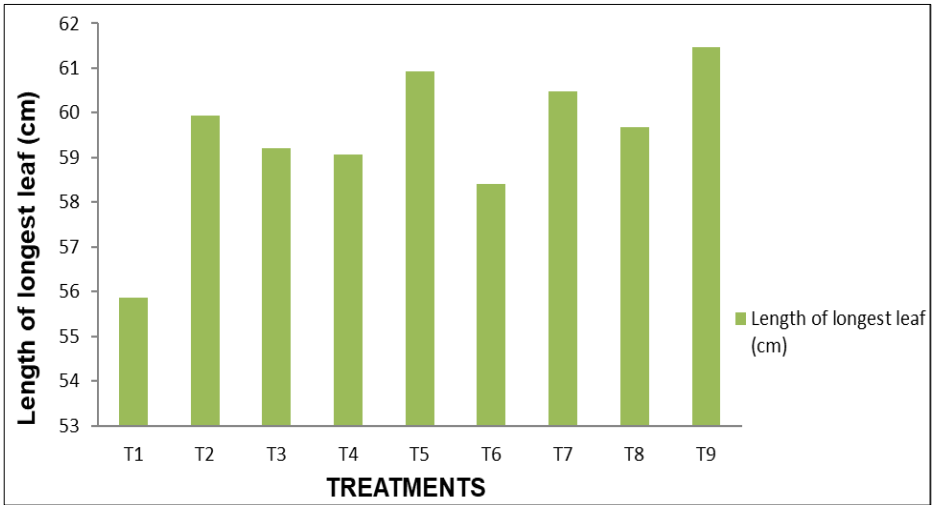

Fig 2: Effect of micronutrients on length of longest leaf (cm)

Number of corms per hill

Treatment T_9 best performance for number of corms per hill (2.30) followed by T_8 (2.27) which were statistically similar and significant to other treatments i.e. T_6, T_3, T_2 and T_1 (control) recorded the minimum number of corms per hill (1.40).These results also confirm the findings of Pal. *et al.* (2016) [7] and Sahu *et al.* (2017) [10] in Gerbera.

Zinc might be due to translocation of constituents from one part of other and enhanced production of corms. Lal and Maurya (1981).

Weight of corms per hill (g)

Weight of corms per hill was observed maximum in T_9 (65.43 g) followed by T_8 (61.79 g) both of these treatments were statically similar to each other and differ to control, minimum weight of corms per hill (34.65 g) was recorded by T_1 (control). Similar findings were observed by Singh and Singh (2000) [13] in gladiolus.

Number of cormels per hill

Maximum number of cormels per hill were taken by T_9 (10.60) followed by T_8 (8.95) which treatments are statistically similar to each other and minimum number of cormels per hill (4.13) was recorded under control. Halder *et al.* (2007) [5].

These may be due $ZnSO_4$ is indispensable for proper growth and development of plants. Zinc is effective in plant nutrition for the synthesis of plant hormones and balancing intake of P and K inside the plant cells (Sharma *et al.*, 2013 in gladiolus) [11].

Weight of cormels per hill (g)

The maximum weight of cormels per hill were observed in treatment T_9 (1.70g) followed by T_8 (1.32g) and T_7 (1.11g) and the minimum weight of cormels per hill (0.56) was recorded by T_1 (control). Similar result on number of leaves was observed by Rawia *et al.* (2010) in tuberose. This might be due to weight of cormels per hill increased by accumulation of proteins in cormels (Reddy and Rao 2012) [8].

Diameter of corm (cm)

Corm diameter was recorded maximum in treatment T_8 (4.73 cm) which was followed by (4.71cm) with T_7. The minimum diameter of corm (4.09 cm) was recorded under control. given by Sharova *et al.* 1977 [12] in gladiolus. These finding has similarity with the result Increased corm size with zinc sprays might be due to increased cell division and greater mobilization of photosynthates to the places where the corms are formed (Reddy and Rao 2012) [8].

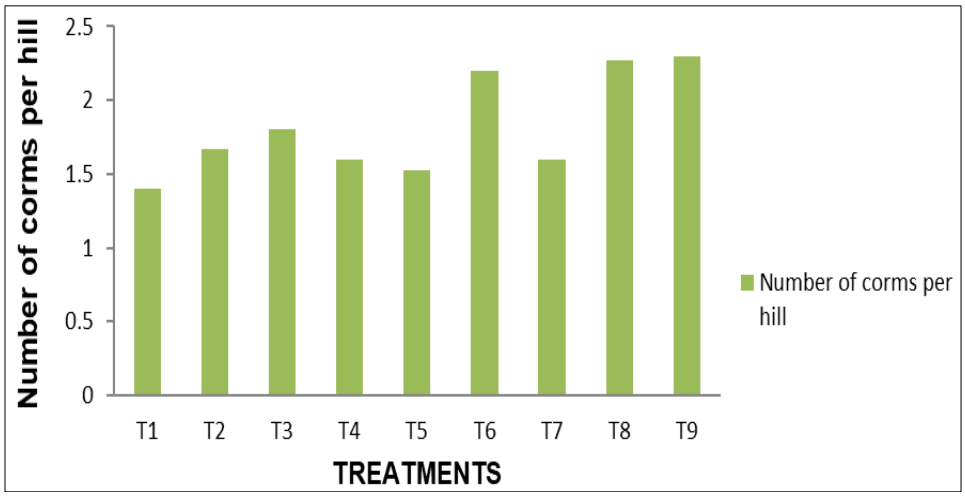

Fig 3: Effect of micronutrients on number of corms per hill

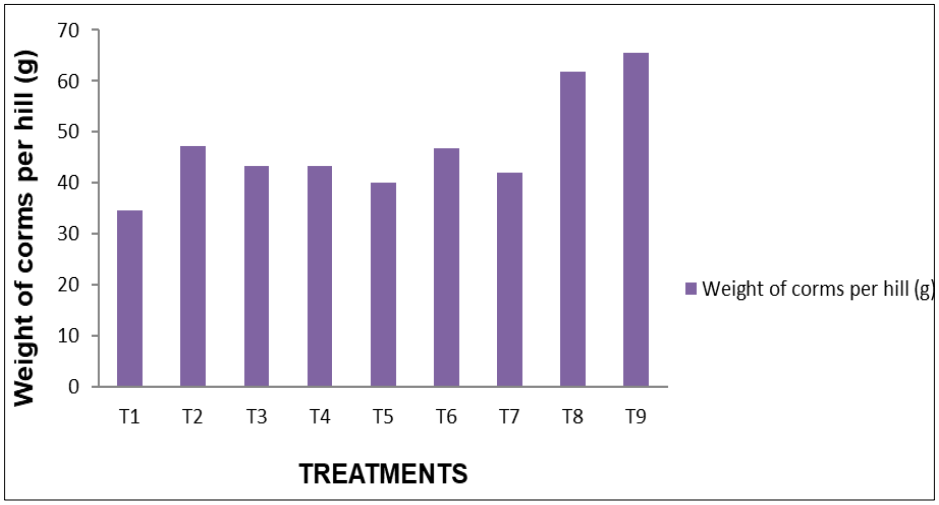

Fig 4: Effect of micronutrients on weight of corms per hill (g)

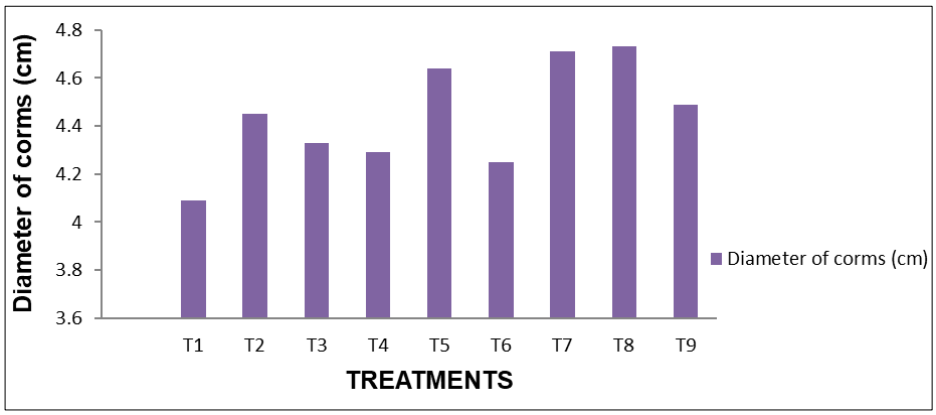

Fig 5: Effect of micronutrients on diameter of corms (cm)

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