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EFFECT OF BORON AND MANGANESE ON GROWTH AND FLOWERING OF GLADIOLUS

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Abstract

The investigation entitled "Effect of boron and manganese on growth and flowering of gladiolus" was carried out during *rabi* season of the year 2015-16 at Satpuda Botanic Garden, College of Agriculture, Nagpur with nine treatment combinations in Factorial Randomized Block Design. The treatments comprised of three levels each of boron and manganese (control *i.e.* water spray, 0.1% and 0.2%). The results revealed that foliar application of 0.1% boron and 0.1% manganese recorded significantly maximum flower yield in respect of spikes plant^{-1} and improved quality in respect of florets spike^{-1} and vase life of spike and also noted the the earliest first spike emergence and opening of first floret in gladiolus. However, vegetative growth of the plant in respect of plant height and leaf area and length of spike in gladiolus were recorded significantly maximum when the plants sprayed with combined spray of 0.1% each of boron and manganese.

Key words **:** Gladiolus, boron, manganese, growth, spikes.

Introduction

Gladiolus (*Gladiolus grandiflorus* L.) belonging to family *Iridaceae* is one of the most popular ornamental bulbous flower crops grown commercially for its bewitching flowers. It is therefore necessary to increase flower yield by adopting some advanced technologies. micronutrient sprays with optimum concentrations have a role in improving flower yield and they also play important role in improving the vase life. Although, the requirement of micronutrients is relatively less but their role in normal crop production is indispensible, because of their active role in plant metabolic processes, involving in cell wall development, photosynthesis, chlorophyll formation, respiration, various enzyme activities, hormone synthesis and nitrogen fixation. Hence, an experiment was undertaken to study the influence of foliar application of micronutrients like boron and manganese on growth and flowering of gladiolus.

Materials and Methods

The present investigation was carried out at Satpuda Botanic Garden, College of Agriculture, Nagpur during *rabi* season of the year 2015-16 to study the effect of foliar application of boron and manganese on growth and flowering of gladiolus and find out suitable concentration of both the nutrients for production of higher yield of better quality spikes of gladiolus var. 'American Beauty' with three replications and nine treatment combinations in Factorial Randomized Block Design. The treatments comprised of different levels of boron and manganese (0% *i.e.* water spray, 0.1% and 0.2% each).

After preparatory tillage operations, well-rotted FYM @ 20 t ha^{-1} was mixed uniformly in the soil before last harrowing. The field was laid out with the beds of ridges and furrows. The rested, cold stored and uniform sized gladiolus corms of the variety 'American Beauty' were treated with copper fungicide for 15 minutes before planting. The corms were planted at the spacing of 45 × 15 cm on ridges and furrows at 5 cm depth. After land preparation and planting of gladiolus corms the solutions of boron and manganese each of 0 (water spray), 0.1 and 0.2% were sprayed twice at 20th and 30th day after planting individually and in combination as per the treatments. The various observations on growth, flowering, yield and quality parameters of gladiolus spikes were recorded and analysed statistically.

Results and Discussion

The data presented in table 1 revealed that, different levels of boron and manganese had significant effect on all growth, flowering, yield and quality parameters of gladiolus studied in this experiment. However, interaction

Table 1 : Growth and flowering of gladiolus as influenced by foliar application of boron and manganese.

Treatments	Plant height (cm)	Leaf area (cm^2)	Days for first spike emergence (days)	Days for opening of first floret (days)	Spikes $plant^{-1}$	Length of spike (cm)	Florets $spike^{-1}$	Vase life of spike (days)
Factor A – Boron								
B_1- 0% (Control)	81.89	113.52	59.85	72.93	2.76	78.37	10.06	8.18
B_2- 0.1% Boron	86.90	128.35	55.46	69.31	3.22	81.93	11.88	9.90
B_3- 0.2% Boron	85.25	121.03	57.16	70.86	3.01	79.79	10.92	9.04
SE (m) ±	0.30	0.95	0.64	0.60	0.08	0.23	0.25	0.19
CD at 5%	0.89	2.85	1.91	1.81	0.23	0.70	0.76	0.56
Factor B – Manganese								
M_1- 0% (Control)	82.27	117.09	58.88	72.50	2.65	77.11	9.96	8.31
M_2- 0.1% Manganese	86.97	125.32	56.07	69.50	3.24	82.39	11.72	9.73
M_3- 0.2% Manganese	84.80	120.50	57.51	71.10	3.12	80.60	11.18	9.07
SE (m) ±	0.30	0.95	0.64	0.60	0.08	0.23	0.25	0.19
CD at 5%	0.89	2.85	1.91	1.81	0.23	0.70	0.76	0.56
Interaction (AXB)								
SE (m) ±	0.52	1.65	1.10	1.05	0.13	0.41	0.44	0.32
CD at 5%	1.55	4.94	-	-	-	1.22	-	-

Table 2 : Interaction effect of boron and manganese on growth and flowering of gladiolus.

Treatment combinations	Plant height (cm)	Leaf area (cm^2)	Length of spike (cm)
B_1M_1	78.68	102.09	75.73
B_1M_2	86.85	123.69	80.42
B_1M_3	80.14	114.77	78.95
B_2M_1	83.70	123.01	78.00
B_2M_2	89.25	133.95	84.12
B_2M_3	87.74	128.09	83.68
B_3M_1	84.44	126.16	77.59
B_3M_2	84.80	118.31	82.62
B_3M_3	86.52	118.63	79.17
SE (m) ±	0.52	1.65	0.41
CD at 5%	1.55	4.94	1.22

effect of boron and manganese was found to be non-significant in respect of all the parameters except plant height, leaf area and length of spike in gladiolus.

Growth

Significantly maximum plant height (86.90 cm) and leaf area (128.35 cm^2) in gladiolus were recorded with foliar application of boron 0.1 % and it was followed by boron 0.2 % (85.25 cm and 121.03 cm^2, respectively). Similarly, foliar spray of manganese 0.1% noted significantly the highest plant height (86.97 cm) and leaf area (125.32 cm^2) and it was followed by 0.2% manganese (84.80 cm and 120.50 cm^2, respectively). Whereas, the lowest plant height (81.89 and 82.27 cm) and leaf area (113.52 and 117.09 cm^2) were noticed with 0% each of boron and manganese *i.e.* water spray. However, in respect of interaction effect, the treatment combination of B_2 M_2 *i.e.* foliar spray of 0.1% boron + 0.1% manganese recorded significantly the tallest plants (89.25 cm) with maximum leaf area (133.95 cm^2), which was followed by B_2 M_3 (87.74 cm and 128.09 cm^2, respectively).

Foliar application if 0.1% boron with 0.1% manganese recorded maximum vegetative growth in respect of plant height and leaf area. The primary role of boron in plants is to improve Ca metabolism and improved solubility and mobility of Ca and helps in absorption of nitrogen. However, manganese plays important role in chlorophyll formation for photosynthesis, nitrate assimilation and for the activity of several enzymes because of which the vegetative growth of plant might have been enhanced. These findings confirm the results of Khalifa *et al.* (2011) in Iris plant and Maurya and Kumar (2014) in gladiolus.

Flowering

The foliar treatment of 0.1% boron and 0.1% manganese took significantly minimum days for first spike emergence (55.46 and 56.07 days, respectively) and opening of first floret (69.31 and 69.50 days, respectively) which were found to be at par with 0.2% boron and 0.2% manganese, respectively, whereas, the control treatment

(water spray) recorded maximum days for first spike emergence (59.85 and 58.88 days, respectively) and opening of first floret (72.93 and 72.50 days, respectively). The interaction effect of boron and manganese on days for first spike emergence and opening of first floret in gladiolus was found to be non-significant.

An early flowering with 0.1% each of boron and manganese might be due to enhanced growth and development of plants. The micronutrients like boron and manganese play an active role in plant metabolic processes, photosynthesis, various enzyme activities, hormone synthesis, nitrogen fixation etc. This may be the attributing factor for positive effectiveness of optimum dose of boron and manganese on reducing juvenile phase of the plants. The results obtained are in confirmation with the findings of Fahad *et al*. (2014) in gladiolus.

Flower yield and quality

In this experiment, total number of gladiolus spikes plant^{-1} was noticed significantly maximum with the foliar treatments of 0.1% boron (3.22) and 0.1% manganese (3.24), which were statistically on par with 0.2% boron (3.01) and 0.2% manganese (3.12), respectively, whereas, the control treatment *i.e*. 0% boron and 0% manganese (water spray) counted significantly lowest spikes plant^{-1} (2.76 and 2.65, respectively). The interaction effect of boron and manganese on spikes plant^{-1} in gladiolus was found to be non-significant.

In respect of the flower quality parameters like spike length, florets spike^{-1} and vase life of spike in gladiolus, the foliar treatment of 0.1% boron exhibited significantly maximum values (81.93 cm, 11.88 and 9.90 days, respectively), which was followed by 0.2% boron (79.79 cm, 10.92 and 9.04 days, respectively), however, the control treatment *i.e*. water spray recorded minimum values (78.37 cm, 10.06 and 8.18 days, respectively).

Similarly, spike length (82.39 cm), florets spike^{-1} (11.72) and vase life of spike (9.73 days) in gladiolus were recorded significantly the highest with the foliar treatment of 0.1% manganese and it was followed by 0.2% manganese (80.60 cm, 11.18 and 9.07 days, respectively), whereas, the control treatment (water spray) recorded minimum values (77.11 cm, 9.96 and 8.31 days, respectively).

Interaction effect of boron and manganese on florets spike^{-1} and vase life of spike in gladiolus was found to be non-significant, however, it was significant in respect of length of spike. The treatment combination of B_2M_2 *i.e.* foliar spray of 0.1% boron + 0.1% manganese exhibited significantly highest length of spike (84.12 cm) and it was statistically on par with B_2M_3 (83.68 cm) *i.e.* foliar spray of 0.1% boron + 0.2% manganese, however, the lowest length of spike was recorded with the treatment combination of B_1M_1 (75.73 cm) *i.e.* foliar spray of 0% boron + 0% manganese (water spray).

Foliar application of 0.1% boron and 0.1% manganese recorded significantly maximum yield of gladiolus spikes with superior quality. This might be due to increased availability of photosynthates as a result of enhanced growth rate of vegetative plant parts due to foliar application of 0.1 % each of boron and manganese, which might have been utilized for increasing the yield of better quality spikes in respect of length of spike and florets spike^{-1} and increased their turgidity. These results are in accordance with those obtained by Fahad *et al*. (2014) in gladiolus and Kode *et al*. (2015) in rose.

Thus, it can be inferred from the present investigation that, foliar application of 0.1% each of boron and manganese increased vegetative growth and flower yield and improved flower quality in gladiolus.

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