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EFFECT OF MICRONUTRIENTS SPRAY ON GROWTH, YIELD AND FLOWER QUALITY OF GLADIOLUS CV. WHITE PROSPERITY

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ABSTRACT : The present investigation on effect of micronutrients spray on plant growth, spike yield and flower quality of gladiolus (*Gladiolus grandiflorus* L.) cv. White Prosperity was undertaken in the Department of Horticulture, SHIATS, Allahabad. The experiment was laid out in RBD (5 x 5 Factorial), having five levels each of zinc (0.0%, 0.2%, 0.3%, 0.4% and 0.5%) and boron (0.0%, 0.2%, 0.3%, 0.4% and 0.5%), consisting a total of 25 treatment combinations. Results showed that the foliar application of boron and zinc alone at all rates and as combination significantly influenced plant growth, spike yield and flower quality with maximum value at 0.4% boron and 0.4% zinc levels. As a result of interaction between boron and zinc, the best results regarding plant growth, spike yield and flower quality were obtained with treatment combination B_3 Z_3 (B 0.4% + Zn 0.4%).

Keywords : *Gladiolus, micronutrient, boron, zinc, growth, flower yield, quality.*

The requirement of fertilizers like other crops has vital role in growth, quality of flowers, and corm and cormel production. Gladiolus is highly responsive to chemical fertilizers. It has been reported that nitrogen, phosphorus, potassium with micro-nutrients especially boron and zinc remarkably increased weight and number of corms and cormels per hill (Halder *et al*. 1; and Singh and Singh, 7). Micronutrients such as boron and zinc (Halder *et al*. 1, and Jauhari *et al.* 2) had greatly affected the plant growth and development. The main function of boron is related to cell wall strength and development, cell division, sugar transport, and hormones development, RNA metabolism, respiration, IAA metabolism and as part of the cell membranes (Marschner, 5). The availability of micronutrients to plants is determined by both the total amount of the nutrients in the soil and the soil's properties. Other factor such as crop species and variety, can also influence the degree of which micronutrients levels affect crop production.

MATERIALS AND METHODS

The present investigation on effect of micronutrients spray on growth, yield and flower quality of gladiolus (*Gladiolus grandiflorus* L.) cv. White Prosperity was undertaken in the experimental field of the Department of Horticulture, SHIATS, Allahabad during 2012-2013. Allahabad is situated at an elevation of 78 m MSL at 25.87^0 N latitude and 81.15^0 E longitude. The area of Allahabad district comes under subtropical belt in the south -east of Uttar Pradesh, which experiences extremely hot summer and fairly cold winter. The maximum temperature of the location reaches up to 46 ^{0}C – 48 ^{0}C and seldom falls as low as 4 ^{0}C – 5 ^{0}C. The relative humidity ranges between 20 to 94%. The study was laid out in RBD (5x 5 Factorial), having five levels each of Zinc (0.0%, 0.2%, 0.3%, 0.4% and 0.5%) and Boron (0.0%, 0.2%, 0.3%, 0.4% and 0.5%), consisting a total of 25 treatment combinations. Foliar spray of zinc and boron was done at 15 days intervals up to flowering of plant. Observations were recorded on three randomly selected plants of each treatment to assess the effect of treatments on plant growth, spike yield and flower quality of the flower. Average data (Table 1 & 2) were analyzed statistically.

RESULTS AND DISCUSSION

Effect of boron on growth, yield and flower quality

A perusal of Table 1 shows that maximum plant height (94.19cm) and number of leaves/plant (22.44) were obtained with boron spray @ 0.4% followed by with boron @0.5% (87.05cm height, 20.67 leaves), and the minimum plant height (77.59 cm) and number of leaves per plant (18.47) were recorded under control. The findings are in conformity with reports made by Jauhari *et al.* (2) in gladiolus. Maximum number of shoots per corm (2.20) was recorded with boron level of 0.4% followed by with B_4 (1.95) and the minimum shoots (1.39) remained with control. Minimum days to spike initiation (62.89 days) as well as days to opening of first floret (74.07days) were obtained with Boron @ 0.4% followed by Boron @ 0.5% (64.73 days and 76.24 days), and the maximum days to spike emergence

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Table 1: Effect of different levels of boron and zinc on plant growth, spike and corn yield and flower quality of gladiolus cv. White Prosperity.

Treatments	Plant height	No. of leaves / plant	No. of shoot/ corm	Days to spike initiation	Days to opening of first floret	No. of spikes/ plant	Spike yield/ha (lakh)	No. of corms/ plant	Corm yield/ ha (lakh)	No. of cormlets/corm	Cormel yield/ ha (lakh)	Floret size (cm)	Shelf life of spike (Days)	First floret durability (Days)	Spike length (cm)	No. of florets per spike
Levels of Boron (B)																
B_0-Boron 0.0%	77.59	18.47	1.39	68.39	80.57	1.12	1.96	1.43	2.50	7.75	13.56	7.81	9.56	8.69	72.09	13.87
B_1-Boron 0.2%	81.44	19.36	1.56	67.08	79.04	1.23	2.15	1.59	2.78	9.27	16.22	8.21	10.09	9.15	74.31	15.41
B_2-Boron 0.3%	83.57	19.92	1.71	66.03	77.75	1.36	2.38	1.72	3.01	10.48	18.34	8.49	10.45	9.41	75.93	16.12
B_3-Boron 0.4%	94.19	22.44	2.20	62.89	74.07	1.75	3.06	2.24	3.92	12.63	22.10	9.33	11.48	10.47	79.61	17.97
B_4-Boron 0.5%	87.05	20.67	1.95	64.73	76.24	1.55	2.71	1.96	3.43	11.40	19.95	8.79	10.77	9.84	77.45	16.83
C. D. ($P = 0.05$)	0.23	0.06	0.10	0.12	0.14	0.05	0.09	0.05	0.09	0.04	0.08	0.05	0.05	0.05	0.12	0.05
Levels of Zinc (Z)																
Z_0- Zinc 0.0%	75.56	17.91	1.21	70.28	82.79	1.07	1.87	1.25	2.19	6.85	11.99	7.60	9.28	8.41	70.97	13.35
Z_1- Zinc 0.2%	85.23	20.28	1.83	65.36	76.97	1.41	2.47	1.84	3.22	10.57	18.50	8.59	10.56	9.60	76.33	16.24
Z_2-Zinc 0.3%	86.36	20.56	1.87	64.95	76.48	1.47	2.57	1.87	3.27	10.95	19.16	8.69	10.67	9.69	76.77	16.60
Z_3-Zinc 0.4%	89.23	21.29	1.99	63.96	75.35	1.56	2.73	2.03	3.55	11.81	20.67	8.96	11.05	10.04	78.00	17.21
Z_4-Zinc 0.5%	87.47	20.81	1.91	64.57	76.08	1.49	2.61	1.95	3.41	11.33	19.83	8.80	10.80	9.81	77.32	16.80
C. D. ($P = 0.05$)	0.23	0.06	0.10	0.12	0.14	0.05	0.09	0.05	0.09	0.04	0.08	0.05	0.05	0.05	0.12	0.05

(68.39days) and days to opening of first floret (80.57 days) were recorded under control. Yield of spikes/plant and per unit area was also influenced significantly by micronutrient's spray. Maximum number of spikes/ plant (1.75) as well as highest yield of spikes/hectare (3.06 lakh spikes) were recorded by the spray of 0.4% boron followed by B_4 level (1.55 spike/plant; 2.71 lakh spikes/ha), and the minimum yield of spikes/plant (1.12) and per hectare (1.96 lakh) were observed in control plots. These findings are in agreement with Reddy and Chaturvedi (6). The maximum number of daughter corms/plant (2.24) and corm yield/ hectare (3.92 lakh) were found in treatment B_3 (Boron @0.4%) and they were minimum in control plots. Like this, yield of cormels was also found maximum (12.63 cormels/ planted corm, and 22.10 lakh cormels/ha) with spray of boron @0.4% and control plots showed minimum values for cormlets production. The results are in agreement with the results of Singh and Singh (7) and Kumar and Arora (4) in gladiolus.

Spike length, flower size and durability of flower are the most important traits to determine the quality of a flower. It is obvious from Table 1 that the maximum floret size (9.33cm), longest shelf life of spike (11.48 days) as well as durability of first floret (10.47 days) were recorded under the flowers obtained from plants sprayed with boron @0.4% followed by boron spray of 0.5% (8.79cm flower size, 10.77 days and 9.84 days) while control plants showed the minimum values for these parameters. The longest spike length (79.61 cm) and maximum number of florets/spike (17.97) were resulted in plants treated with boron @0.4%) followed by boron @ 0.5% (77.45 cm long spike and 16.83 florets/spike) and least values were recorded in control. These findings are in consonance with Katiyar *et al.* (3) and Singh *et al.* (8)

Effect of zinc on plant growth, yield and flower quality

A perusal of Table 1 shows that maximum plant height (89.23cm) and number of leaves/plant (21.29) were obtained with zinc spray @ 0.4% followed by with zinc @ 0.5% (87.47 cm height, 20.81 leaves), and the minimum plant height (75.56 cm) and number of leaves per plant (17.91) were recorded under control. The findings are in conformity with reports made by Jauhari *et al.* (2) and Singh and Singh (7). Number of shoots/mother corm were also produced maximum (1.99) in plants sprayed with 0.4% zinc followed by 0.5% zinc (1.91

Table 2: Interaction effect of different levels of Boron and Zinc growth, spike yield and flower quality of Gladiolus (Gladiolus grandiflorus L.) cv. White Prosperity.

Treatment	Plant height	No. of leaves / plant	No. of shoot / corm	Days to spike initiation	Days to opening of first floret	No. of spikes/ plant	Spike yield/ hectare (lakh)	No. of corms/ plant	Corm yield/ ha (lakh)	No. of cormlets/ha corm	Cormlet yield/ ha (lakh)	Floret size (cm)	Shelf life of spike (Days)	First floret durability (Days)	Spike length (cm)	Number of florets per spike
T_0 B_0Z_0	67.67	15.93	1.00	71.87	84.67	1.00	1.75	1.07	1.87	6.33	11.08	6.73	8.13	7.67	65.67	11.33
$T_1B_0Z_1$	79.07	18.87	1.47	68.27	80.40	1.13	1.98	1.47	2.57	7.53	13.18	8.00	9.80	8.87	73.33	14.33
$T_2B_0Z_2$	79.80	19.07	1.47	67.60	79.60	1.13	1.98	1.47	2.57	7.87	13.77	8.07	9.87	8.93	73.53	14.47
$T_3B_0Z_3$	81.07	19.33	1.53	66.93	78.93	1.20	2.10	1.60	2.80	8.73	15.28	8.13	10.07	9.07	74.13	14.67
$T_4B_0Z_4$	80.33	19.13	1.47	67.27	79.27	1.13	1.98	1.53	2.68	8.27	14.47	8.13	9.93	8.93	73.80	14.53
$T_5B_1Z_0$	76.53	18.07	1.13	70.67	83.27	1.07	1.87	1.13	1.98	6.67	11.67	7.67	9.33	8.47	71.33	13.60
$T_6B_1Z_1$	81.73	19.47	1.60	66.60	78.47	1.20	2.10	1.67	2.92	9.13	15.98	8.20	10.13	9.13	74.53	14.87
$T_7B_1Z_2$	82.47	19.67	1.67	66.33	78.13	1.27	2.22	1.67	2.92	9.73	17.03	8.33	10.20	9.27	74.87	16.07
$T_8B_1Z_3$	83.60	19.87	1.73	65.73	77.47	1.33	2.33	1.73	3.03	10.67	18.67	8.47	10.47	9.47	75.67	16.33
$T_9B_1Z_4$	82.87	19.73	1.67	66.07	77.87	1.27	2.22	1.73	3.03	10.13	17.73	8.40	10.33	9.40	75.13	16.20
T_{10} B_2Z_0	77.27	18.33	1.20	70.20	82.67	1.07	1.87	1.20	2.10	6.93	12.13	7.80	9.53	8.53	72.27	13.73
T_{11} B_2Z_1	84.13	20.07	1.80	65.47	77.07	1.33	2.33	1.80	3.15	10.93	19.13	8.53	10.53	9.53	76.07	16.47
T_{12} B_2Z_2	84.73	20.20	1.80	65.13	76.67	1.40	2.45	1.80	3.15	11.13	19.48	8.67	10.67	9.53	76.67	16.60
T_{13} B_2Z_3	86.33	20.67	1.87	64.47	75.93	1.53	2.68	1.93	3.38	11.87	20.77	8.73	10.80	9.80	77.60	17.00
T_{14} B_2Z_4	85.40	20.33	1.87	64.87	76.40	1.47	2.57	1.87	3.27	11.53	20.18	8.73	10.73	9.67	77.07	16.80
T_{15} B_3Z_0	78.53	18.73	1.40	69.00	81.27	1.13	1.98	1.53	2.68	7.27	12.72	7.93	9.73	8.73	72.93	14.13
T_{16} B_3Z_1	93.47	22.13	2.27	62.33	73.40	1.80	3.15	2.27	3.97	13.13	22.98	9.33	11.47	10.53	79.73	18.27
T_{17} B_3Z_2	96.07	22.87	2.33	61.93	72.93	1.87	3.27	2.33	4.08	13.67	23.92	9.47	11.67	10.67	80.27	18.53
T_{18} B_3Z_3	104.07	24.93	2.60	59.80	70.40	2.00	3.50	2.67	4.67	14.93	26.13	10.27	12.67	11.53	83.40	20.13
T_{19} B_3Z_4	98.80	23.53	2.40	61.40	72.33	1.93	3.38	2.40	4.20	14.13	24.73	9.67	11.87	10.87	81.73	18.80
T_{20} B_4Z_0	77.80	18.47	1.33	69.67	82.07	1.07	1.87	1.33	2.33	7.07	12.37	7.87	9.67	8.67	72.67	13.93
T_{21} B_4Z_1	87.73	20.87	2.00	64.13	75.53	1.60	2.80	2.00	3.50	12.13	21.23	8.87	10.87	9.93	78.00	17.27
T_{22} B_4Z_2	88.73	21.00	2.07	63.73	75.07	1.67	2.92	2.07	3.62	12.33	21.58	8.93	10.93	10.07	78.53	17.33
T_{23} B_4Z_3	91.07	21.67	2.20	62.87	74.00	1.73	3.03	2.20	3.85	12.87	22.52	9.20	11.27	10.33	79.20	17.93
T_{24} B_4Z_4	89.93	21.33	2.13	63.27	74.53	1.67	2.92	2.20	3.85	12.60	22.05	9.07	11.13	10.20	78.87	17.67
CD (P=0.05)	0.52	0.12	-	0.27	0.32	0.11	0.20	0.12	0.21	0.10	0.17	0.12	0.12	0.11	0.26	0.12

shoots) and minimum shoots/corm (1.21) were recorded under control. Days to spike emergence (63.96 days) and days to opening of first floret (75.35 days) were recorded significantly minimum with spray of 0.4% zinc. Jauhari *et al.* (2), Singh *et al.* (8) and Reddy and Chaturvedi (6) had also reported similar findings regarding above characters studied. Yield of spikes and daughter corms and cormels were also influenced significantly due to spray of zinc. Maximum number of spikes/plant (1.56) and daughter corms/plant (2.03), higher spike and corm yield per hectare (2.73 lakh and 3.55 lakh, respectively) as well as cormels yield (11.81/plant and 20.67 lakh/ha) were also found with the application of 0.4% zinc followed zinc @0.5% (1.49 spikes/plant, 2.61 lakh spikes/ha, 1.95 corms/plant, 3.41 lakh corms/ha, and 11.33 cormels/plant and 19.83 lakh cormels/ha). Similar findings due to application of macro and micro nutrients had also been reported by Halder *et al.* (1), Kumar and Arora (4) and Singh and Singh (7).

The maximum floret size (8.96 cm), maximum shelf life of spike (11.05 days) and durability of first floret 10.04 days), longest spike (78.00 cm) and highest number of florets/spike (17.21) were also obtained due to spray of zinc at 0.4% level followed by 0.5% zinc as compared to control and other lower levels of zinc. These findings are in consonance with reports of Katiyar *et al.* (3), and Singh *et al.* (8).

Interaction effect of boron and zinc:

A perusal of data revealed that combined spray effect of both the micronutrients *i.e.* boron and zinc had influenced significantly to all the parameters studied (Table 2). Gladiolus cv. White Prosperity crop sprayed with boron and zinc each at 0.4% level resulted in highest plant height (104.07 cm), number of leaves and

shoots per plant (24.93 and 2.60, respectively), earliest spike emergence (59.80 days) and opening of first floret (70.40 days). Control plants showed minimum values for these parameters confirming to reports of Katiyar *et al.* 3). Spike yield/plant (2.0) and per hectare (3.50 lakh), yield of corms/plant (2.67) and per hectare (4.67 lakh) as well as cormels yield/mother corm (13.67) and per hectare (23.92 lakh) were also found maximum due to interaction of 0.4% each of boron and zinc confirming to the reports of Halder *et al.* (1) and Singh *et al.* (8).

Results revealed that longet spike (83.40 cm), maximum number of florets/spike (20.13), largest sized floret (10.27 cm), and maximum shelf life of spike (12.67 days) as well as durability of first floret (11.53 days) were obtained due to interaction of boron and zinc at 0.4% level each. The results are in support of Halder *et al.* (1) and Katiyar *et al.* (3).

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