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EFFECT OF FOLIAR SPRAY OF ZINC, CALCIUM AND BORON ON SPIKE PRODUCTION OF GLADIOLUS CV. EUROVISION

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ABSTRACT: The experiment was carried out on spike production in gladiolus with foliar application of zinc, calcium and boron, conducted in Horticulture Garden of Chandra Shekhar Azad University of Agriculture and Technology Kanpur in Randomized Block Design with four replications. The experimental plots were 32 with 8 treatments and two levels of each of zinc, calcium and boron treated by zinc sulphate 0.5%, calcium sulphate 0.75% and borax 0.2%, respectively. The results obtained revealed that the foliar spray of zinc at 0.5% to gladiolus plant was most effective to influence the vegetative growth and size of spike.

Keywords : *Zinc, calcium, boron, gladiolus, spike.*

Gladiolus, called as sword lily, belongs to the family Iridaceae and sub-family Irioideae. Gladiolus is a beautiful ornamental bulbous plant, grown for its bewitching and glamorous flowers. Gladiolus is grown on herbaceous border, bed, rockery, pot and also for cut flowers. It is grown in several states of India and successfully grown in plains as well as in hills. Light sandy soil with 6-7 pH and sunny weather is most congenial for its growth and development. Among micronutrients required in small amount, boron is necessary for carbohydrate transport within the plant (Gauch and Dugger, 3) and most of absorbed by the plants in undissociated boric acid (H_3BO_3). Zinc is essential for carbon dioxide evolution and utilization of carbohydrate and phosphorus metabolism and synthesis of RNA. Calcium is the chief constituent of plants as calcium pectate of middle lamella of cell wall and is therefore an important part of of plant structure. Calcium is involved in formation of cell membrane (Hewitt, 4). In our country not much work has been done on production of spike of gladiolus with foliar spray of zinc, calcium and boron. Most of the information are available based on the work carried out in the foreign countries but those recommendations can not be help full as such under our agro-climatic condition. Hence the cultural management and technique for quality flower spike production need to be developed and standardized. Keeping in view of the above facts, a field trial was conducted to investigate the effect of zinc, calcium and boron on production of spike in gladiolus.

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MATERIALS AND METHODS

The experiment was laid out at Horticulture Garden of C.S.A. University of Agriculture and Technology Kanpur, where climatic condition is semi-arid and sub-tropical with hot dry summer and cold winter. Randomized block design with four replication was selected for eight treatment combinations, two levels of each of zinc (0, 0.5%), calcium (0, 0.75%) and boron (0, 0.2%) were treated by zinc sulphate 0.5%, calcium suphate 0.75% and borax 0.2%, respectively. The planting of corms were done on Ist November 2006. First irrigation at the time of land preparation and regular irrigation was carried at an interval of 15 days. Five weedings and six hoeings during cropping period were done and earthing was done when the plant was erect at 20-22 cm height. The nitrogen, phosphorus and potash were applied at the rate of 160, 80, 80 kg/ha, respectively. Nitrogen was applied in two splits of 80 kg/ha each, first at the time of soil preparation and second at six leaves stage. FYM was also added equaly to each plot. The observations on each treatment were recorded on the growth and flowering characters.

RESULTS AND DISCUSSION

The field trial was mainly aimed to test the effect of zinc, calcium and boron on growth, flowering and production of spike of gladiolus. Calcium is the chief constituent of plant, as calcium pectate is present in middle lamella of cell wall. It is essential for metabolism, nitrate assimilation, binding of nucleic acid with protein and is involved in the formation of cell membranes. Boron is necessary for carbohydrate transport within the plant. It is involved in cellular differentiation and development, nitrogen metabolism, fertilization, active salt absorption, harmone metabolism, water relation and photosynthesis. Zinc is involved in the synthesis of auxin and it is essential for carbon dioxide evolution and utilization of carbohydrate and phosphorus metabolism. Gladiolus being a monocotyledonous plant has no cambium in vascular bundles and the vascular bundles were scattered among the tissue unsystematically. So that no secondary growth occurs in this plant and mostly it grows without branching. Therefore, spraying of zinc, calcium and boron were sprayed separately.

The plant height was not significantly affected by spraying of calcium. The dala (Table 1) indicated that the maximum height (81.70cm) was attained with the application of zinc. The reason for increase in height of gladiolus might be due to increased synthesis of auxin and utilization of carbohydrate in improving plant height. Similar finding was also observed by Chaturvedi *et al.* (1) in gladiolus.

The length of leaf (57.73 cm) was increased significantly with the application of zinc than calcium and boron. It has been found to play a role in coagulating the auxin concentration and nitrogen metabolism, which might have increased the length of leaf in gladiolus plant. It has also been observed by Sharova *et al.* (6) and Singh and Tiwari (7). The application of zinc increased the width of leaf from 2.50 cm to 2.85 cm, which was in similar to Sharova *et al.* (6) in gladiolus and Singh and Tiwari (7) in onion.

The application of boron increased the number of leaves per plant from 7.96 to 8.44 and application of zinc from 7.66 to 8.74, though the application of calcium was not significant but in presence of zinc increased the number of leaves per plant up to 9.99. this indicated significant interaction of calcium and zinc. The findings are agreed with the finding of Chaturvedi *et al.* (1) and Singh *et al*. (8) in gladiolus. The plants treated with calcium and zinc exhibited more thickness i.e. 1.49 cm and 1.52 cm, respectively. However, boron and different interactions could not increase this parameter. This finding is supported by Makory *et al.* (5) in onion. The width of plant at bottom was significantly affected by the fertilization with calcium and zinc.

The quality of gladiolus spike is mostly recognized by its length and thickness. Length of spike is directly related to nutritional status of plant. The application of calcium and zinc increased the length of spike significantly supported by Chaturvedi *et al.* (1). The thickness of spike was observed maximum with application of zinc followed by calcium and boron. Boron was not found significant supported by Fernandes and Lima Filho (2). Rachis is flower bearing place of the spike which length was increased by boron and calcium application. Longest rachis was produced with calcium followed by boron, and zinc could not affect it significantly, which is in support of Fernandes and Filho (2). Number of florets per spike is also a parameter for judgment of quality of spike. Florets always face in one direction and as such more number of florets per spike enhance the beauty of the spike. The spray of boron and calcium had improved the number of florets per spike significantly. The width and length of floret was significantly affected by application of boron and zinc but calcium could not affect this trait. This finding is in consonance with Chaturvedi *et al.* (1).

Keeping in view the results summarized above it may be concluded that the foliar spraying of zinc at 0.5% to gladiolus plants was effective in influencing most of parameters particularly the size of spike and floret followed by calcium @ 0.75% application.

Table 1: Effect of foliar spray of zinc, calcium and boron on spike production in gladiolus.

(a) B × Ca				(b) Zn × B				(c) Ca × Zn			
Plant height (cm)											
B / Ca	Ca_0	Ca_1	Mean	Zn / B	B_0	B_1	Mean	Ca / Zn	Zn_0	Zn_1	Mean
B_0	80.01	80.07	80.04	Zn_0	78.88	80.92	79.90	Ca_0	79.88	81.62	80.75
B_1	81.50	81.62	81.56	Zn_1	81.20	82.19	81.70	Ca_1	79.92	81.77	80.85
Mean	80.75	80.85	80.80	Mean	80.04	81.56	80.80	Mean	79.90	81.70	80.80
Length of leaf (cm)											
B_0	56.57	56.62	56.60	Zn_0	55.58	55.72	55.65	Ca_0	55.62	57.69	56.65
B_1	56.73	56.83	56.78	Zn_1	57.61	57.85	57.73	Ca_1	55.68	57.77	56.73
Mean	56.65	56.73	56.69	Mean	56.60	56.78	56.69	Mean	55.65	57.73	56.69
Width of leaf (cm)											
B_0	2.58	2.66	2.62	Zn_0	2.45	2.54	2.50	Ca_0	2.47	2.80	2.64
B_1	2.69	2.76	2.72	Zn_1	2.79	2.90	2.85	Ca_1	2.53	2.89	2.71
Mean	2.64	2.71	2.67	Mean	2.62	2.72	2.67	Mean	2.50	2.85	2.67
Number of leaves per plant											
B_0	7.93	7.98	7.96	Zn_0	7.43	7.89	7.66	Ca_0	7.64	8.71	8.18
B_1	8.42	8.45	8.44	Zn_1	8.48	8.99	8.74	Ca_1	7.67	8.76	8.22
Mean	8.18	8.22	8.20	Mean	7.96	8.44	8.20	Mean	7.66	8.74	8.20
Thickness of plant (cm)											
B_0	1.40	1.48	1.44	Zn0	1.37	1.39	1.38	Ca_0	1.34	1.48	1.41
B_1	1.42	1.50	1.46	Zn1	1.51	1.53	1.52	Ca_1	1.43	1.56	1.49
Mean	1.41	1.49	1.45	Mean	1.44	1.46	1.45	Mean	1.38	1.52	1.45
Width of plant (cm)											
B_0	2.52	2.55	2.54	Zn_0	2.51	2.52	2.51	Ca_0	2.49	2.58	2.54
B_1	2.55	2.58	2.56	Zn_1	2.57	2.61	2.59	Ca_1	2.53	2.60	2.57
Mean	2.54	2.57	2.55	Mean	2.54	2.56	2.55	Mean	2.51	2.59	2.55
Duration of heading (days)											
B_0	68.40	66.03	67.22	Zn_0	67.76	65.07	66.17	Ca_0	68.16	68.08	68.12
B_1	67.85	62.20	65.02	Zn_1	67.17	64.97	66.07	Ca_1	64.17	64.06	64.12
Mean	68.12	64.12	66.12	**Mean**	67.71	65.02	66.12	**Mean**	66.17	66.07	66.12

Contd.....

Table 1: Contd…

(a) B × Ca				(b) Zn × B				(c) Ca × Zn			
B / Ca	Ca_0	Ca_1	Mean	Zn / B	B_0	B_1	Mean	Ca / Zn	Zn_0	Zn_1	Mean
Length of spike (cm)											
B_0	55.00	56.33	55.66	Zn_0	54.65	54.77	54.71	Ca_0	54.29	55.51	54.90
B_1	54.80	56.56	55.68	Zn_1	56.68	56.59	56.64	Ca_1	55.13	57.76	56.44
Mean	54.90	56.44	55.67	Mean	55.66	55.68	55.67	Mean	54.71	56.64	55.67
Thickness of spike (cm)											
B_0	0.71	0.75	0.73	Zn_0	0.70	0.71	0.70	Ca_0	0.68	0.75	0.72
B_1	0.72	0.77	0.75	Zn_1	0.77	0.78	0.78	Ca_1	0.72	0.80	0.76
Mean	0.72	0.76	0.74	Mean	0.73	0.75	0.74	Mean	0.70	0.78	0.74
Length of rachis (cm)											
B_0	47.35	49.84	48.59	Zn_0	48.49	50.38	49.44	Ca_0	48.18	48.45	48.32
B_1	49.28	51.72	50.50	Zn_1	48.70	50.62	49.66	Ca_1	50.69	50.87	50.78
Mean	48.32	50.78	49.55	Mean	48.59	50.50	49.55	Mean	49.44	49.66	49.55
Number of florets per spike											
B_0	15.37	18.07	16.72	Zn_0	16.60	18.19	17.39	Ca_0	19.07	16.25	16.16
B_1	16.95	19.54	18.25	Zn_1	16.84	18.31	17.57	Ca_1	18.72	18.89	18.81
Mean	16.16	18.81	17.48	Mean	16.72	18.25	17.48	Mean	17.39	17.57	17.48
Width of floret (cm)											
B_0	7.67	7.75	7.71	Zn_0	7.44	7.78	7.61	Ca_0	7.58	8.07	7.83
B_1	7.98	8.00	7.99	Zn_1	7.98	8.20	8.09	Ca_1	7.64	8.11	7.88
Mean	7.83	7.88	7.85	Mean	7.71	7.99	7.85	Mean	7.61	8.09	7.85
Length of floret (cm)											
B_0	8.52	8.68	8.60	Zn_0	8.38	8.94	8.66	Ca_0	8.63	9.04	8.83
B_1	9.15	9.21	9.18	Zn_1	8.82	9.42	9.12	Ca_1	8.69	9.20	8.95
Mean	8.83	8.95	8.90	Mean	8.60	9.18	8.90	Mean	8.66	9.12	8.90
Longevity of spike on plant (days)											
B_0	14.16	16.99	15.58	Zn_0	15.56	16.61	16.08	Ca_0	14.67	14.73	14.70
B_1	15.24	18.07	16.65	Zn_1	15.60	16.70	16.15	Ca_1	17.49	17.57	17.53
Mean	14.70	17.53	16.11	Mean	15.58	16.65	16.11	Mean	16.08	16.15	16.11

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