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EFFECT OF ZINC, IRON AND COPPER ON YIELD PARAMETERS OF GLADIOLUS

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ABSTRACT: An experiment entitled "Effect of zinc, iron and copper on yield parameters in gladiolus" was carried out at, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur during the year 2010-11. The experiment consisted two levels each of Zn (Zn_0 and Zn_1), Fe (Fe_0 and Fe_1) and Cu (Cu_0 and Cu_1) which were sprayed on gladiolus plant. The dose of foliar spray of zinc, iron and copper were 0.50%, 0.25% and 0.25%, respectively. Weight of corms significantly increased with the application of Zn and Cu (94.38 and 94.82 g, respectively). Diameter of corms influenced significantly with the application of Zn, Fe and Cu (5.71, 5.77 and 5.81 cm diameter, respectively). Foliar spray of Zn, Fe and Cu, significantly increased the number of corms per plant. Interaction between Zn x Fe and Zn x Cu, significantly enhanced number of corms per plant whereas, the number of corms per plant revealed by Zn (1.74), Fe(1.66) and Cu (1.68) over their respective controls. Maximum increase in cormels production per plant was influenced due to application of zinc (44.97) followed by spray of copper (43.18) and iron (42.11) over their respective controls.

Keywords : *Zinc, iron, copper, corms, cormels, gladiolus.*

Flowers symbolize purity, peace, beauty, love and passion. For Indians especially those who are religious mind, flowers have a great significance. In our society no any social function is completed without the use of flowers. Regarding flowers, gladiolus (*Gladiolus species* L.) is one of the most popular ornamental bulbous plants. It has also known as queen of bulbous flowers. It belongs to family Iridaceae, the most attractive group among the flower crops. It has been appropriately providing a symbol of glamour and perfection. It has second rank after tulip among the bulbous flowers in India and has occupied fourth position in the international trade of cut flowers. The fascinating spike bears a large number of florets with varying sizes and forms with smooth ruffle of deeply crinkled sepals, Presently, in India the area under bulbous crop is about 3500 ha of which gladiolus occupies about more than 1200 ha. The main gladiolus growing places are suited to the north Indian plains. It is grown in the plains as well as hills up to elevation of 2400 m from mean sea levels.

The micronutrients play crucial and vital role in gladiolus production as well as major nutrients in growth and development. The effective study on micronutrients and copper under this aspect zinc, iron is necessary in every stage of plant growth particularly in gladiolus as like in other plants. To determinate the commercial value on corm production parameters, the micronutrients contributes most important role on various metabolism and synthesis process in plants. The deficiency of micronutrients create different abnormalities like chlorosis, rosetting and scorching etc.So, due to influence of different important activities in plant metabolism and synthesis, zinc, ferrus and copper were chosen for search out the effect on production parameter in gladiolus. Proper proportion is yet essential as foliar spray for quality and corm production. Keeping this view in mind a field experiment was conducted at Horticulture Garden, Department of Horticulture, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur to investigate the "Effect of zinc, iron and copper on production parameters in gladiolus during 2010-11 to observe their influences on different attributes of production parameters in gladiolus.

MATERIALS AND METHODS

The experiment on "Effect of Zn,Fe and Cu on production parameters in gladiolus was

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conducted at Horticulture Garden, Department of Horticulture ,Chandra Shekhar Azad University of Agriculture and Technology, Kanpur. The corms of 'Sapna' variety of gladiolus was procured from National Botanical Research Institute Lucknow. The experimental field had loamy soil. Manure and fertilizers were given according to recommendation. The experiment was laid out in Factorial Randomized Block Design with three replications and 8 treatments.The treatments were randomized for getting equal chance in respect of fertility. Row to row and plant to plant spacing was maintained 30 x 20 cm, respectively. Irrigation, weeding, hoeing, earthing up and staking operations were completed according to needs. The spray material was zinc sulphate ($ZnSO_4$), ferrus sulphate ($FeSO_4$) and copper sulphate ($CuSO_4$) containing zinc (21%), Fe (19%) and Cu (24%), respectively. Two sprayings were done with the help of hand sprayer after 20 days and 40 days after planting, respectively. The ground of each bed was covered with polythene sheet. The weight of the harvested corms was recorded with the help of electronic balance and average is denoted in grams (g). After one month of spikes duration when leaves become yellow and dry and dryness comes in whole of the aerial portion, the corms were digout. Corms were practiced to clean and diameter of each corm was measured with the help of vernier callipers and indicated in cm.The number of corms and cormels were recorded at the time of lifting the corm.

Table 1: Effect of Zn, Fe and Cu on weight of corms (g).

Zn x Fe					
Zn / **Fe**	Fe_0	Fe_1	Mean	C.D. (P = 0.05)	
Zn_0	92.82	92.59	92.70	Zn	1.04
Zn_1	93.60	95.16	94.38	Fe	NS
Mean	93.21	93.87	93.54	Zn x Fe	NS
Zn x Cu					
Cu / **Zn**	Zn_0	Zn_1	Mean	C.D. (P = 0.05)	
Cu_0	90.94	93.58	92.26	Cu	1.04
Cu_1	94.47	95.18	94.82		
Mean	92.70	94.38	93.54	Zn x Cu	NS
Fe x Cu					
Fe / **Cu**	Cu_0	Cu_1	Mean	C.D. (P = 0.05)	
Fe_0	92.12	94.30	93.21		
Fe_1	92.41	95.34	93.87		
Mean	92.26	94.82	93.54	Fe x Cu	NS
Zn x Fe x Cu					
Zn **Fe** **Cu**	Zn_0Fe_0	Zn_1Fe_0	Zn_0Fe_1	Zn_1Fe_1	C.D. (P = 0.05)
Cu_0	91.43	92.81	90.46	94.36	Zn x Fe x Cu: NS
Cu_1	94.21	94.40	94.73	95.96	

RESULTS AND DISCUSSION

The mean values of data (Table 1) indicated that weight of corms was significantly increased by foliar spray of Zn and Cu. However, it was not affected significantly with Fe. Application of copper influenced the weight of corms exhibiting 94.82 g corm over its control Cu_0 (92.26 g corm). Similarly, it was registered that weight of corm significantly increased with the spray of zinc showing 92.26 g weight, whereas, its control revealed 92.70 g weight. All the first and second order interactions i.e. Zn x Fe, Zn x Cu, Fe x Cu and Zn x Fe x Cu were caused to numerical increase to this parameter but found non significant. These findings are in agreement with the reports of Halder *et. al.* (3) and Singh and Singh (6) in gladiolus and and Ommarvet *et al.* (4) Singh and Tiwari (7) in onion.

The diameter of corms was measured with the help of vernier calipers and average data were calculated (Table 2). The diameter of corm was significantly affected by Zn, Fe and Cu denoting 5.71 cm, 5.81 cm, and 5.77 cm, respectively and their respective controls (Zn_0, Fe_0 and Cu_0) produced (5.50 cm, 5.44 cm and 5.40 cm, respectively). Interaction between Fe x Cu produced significantly biggest corm in respect of diameter followed by F_0Cu_1 (5.73 cm), Fe1Cu0 (5.65 cm) and Fe_0Cu_0 (5.16 cm). First order interactions *i.e.* Zn x Fe and Zn x Cu were statistically skin. The second order interactions i.e.

Table 2: Effect of Zn, Fe and Cu on diameter of corms (cm).

Zn x Fe					
Zn \ **Fe**	Fe_0	Fe_1	Mean	C.D. (P = 0.05)	
Zn_0	5.34	5.66	5.50	Zn	0.06
Zn_1	5.55	5.88	5.71	Fe	0.07
Mean	5.44	5.77	5.61	Zn x Fe	NS
Zn x Cu					
Cu \ **Zn**	Zn_0	Zn_1	Mean	C.D. (P = 0.05)	
Cu_0	5.29	5.52	5.40	Cu	0.09
Cu_1	5.71	5.91	5.81		
Mean	5.50	5.71	5.61	Zn x Cu	NS
Fe x Cu					
Fe \ **Cu**	Cu_0	Cu_1	Mean	C.D. (P = 0.05)	
Fe_0	5.16	5.73	5.44		
Fe_1	5.65	5.89	5.77		
Mean	5.40	5.81	5.61	Fe x Cu	0.10
Zn x FexCu					
Zn Fe Cu	Zn_0 Fe_0	Zn_1 Fe_0	Zn_0 Fe_1	Zn_1 Fe_1	C.D. (P = 0.05)
Cu_0	5.06	5.26	5.53	5.78	Zn x Fe x Cu NS
Cu_1	5.63	5.84	5.80	5.98	

Table 3: Effect of Zn, Fe and Cu on number of corms per plant.

Zn x Fe					
Zn / Fe	Fe_0	Fe_1	Mean	C.D. (P = 0.05)	
Zn_0	1.44	1.49	1.46	Zn	0.08
Zn_1	1.66	1.83	1.74	Fe	0.05
Mean	1.55	1.66	1.60	Zn x Fe	0.07
Zn x Cu					
Cu / Zn	Zn_0	Zn_1	Mean	C.D. (P = 0.05)	
Cu_0	1.43	1.63	1.53	Cu	0.09
Cu_1	1.50	1.86	1.68		
Mean	1.46	1.74	1.60	Zn x Cu	0.07
Fe x Cu					
Fe / Cu	Cu_0	Cu_1	Mean	C.D. (P = 0.05)	
Fe_0	1.46	1.64	1.55		
Fe_1	1.59	1.73	1.66		
Mean	1.53	1.68	1.60	Fe x Cu	NS
Zn x Fe x Cu					
Zn Fe Cu	Zn_0 Fe_0	Zn_1 Fe_0	Zn_0 Fe_1	Zn_1 Fe_1	C.D. (P = 0.05)
Cu_0	1.40	1.53	1.48	1.73	Zn x Fe x Cu NS
Cu_1	1.48	1.80	1.53	1.93	

Zn x Fe x Cu were also found non significant. These finding are in line with reports of Singh and Singh (6) in gladiolus.

Number of corms was counted at the time of digging. Data (Table 3) indicate that foilar spray of Zn,Fe and Cu significantly increased the number of corms per plant showing 1.74,1.66 and 1.68 corms per plant, respectively when compared with their respective controls Zn (1.46), Fe (1.55) and Cu (1.53). Similarly, all the interactions i.e. Zn x Fe and Zn x Cu significantly enhanced the number of corms per plant, revealing Zn_0 x Fe_0(1.44), Zn_0 x Fe_1(1.49),Zn_1 x Fe_0(1.66) and Zn_1 x Fe_1 (1.63), respectively. Similar trends were identified in interaction of Zn x Cu in respect of number of corms per plant. Maximum value was registered in Zn_1Cu_1 (1.86) followed by Cu_0 Zn_1 (1.63). The minimum number of corms was obtained in Cu_0Zn_0 (1.43). The interactions between Fe x Cu were found to be non significant but it was numerically increased. The maximum number of corms were noted in Fe_1Cu_1 (1.73) followed by Fe_0Cu_1 (1.64). Interaction among Zn x Fe x Cu was found to be non significant but numerically increase the number of corms per plant expressing maximum in $Zn_1Fe_1Cu_1$ (1.93). Similar results has been worked out by Ferandes and Lima filho (2), Halder *et al*. (3) and Sharova *et al*. (5) in gladiolus.

The foliar application of Zn, Fe and Cu significantly increased the number of cormels per plant (Table 4). The number of cormels per plant increased by Zn (44.97), Fe (42.11) and Cu (43.18) over their respective controls Zn_0 (33.69), Fe_0 (36.65) and Cu_0 (35.48). Interaction between Zn x Fe and Zn x Cu caused to enhance the number of cormels per plant. The maximum was occurred with Zn_1Cu_1 (51.33) followed by Zn_1Cu_0(49.78), Zn_1Fe_0 (40.16) and Zn_1Cu_0 (38.62). The interaction

Table 4: Effect of Zn, Fe and Cu on number of cormels per plant

Zn x Fe					
Zn \ **Fe**	Fe_0	Fe_1	Mean	C.D. (P = 0.05)	
Zn_0	32.94	34.44	33.69	Zn	1.98
Zn_1	40.16	49.78	44.97	Fe	1.93
Mean	36.55	42.11	39.33	Zn x Fe	2.73
Zn x Cu					
Zn \ **Cu**	Zn_0	Zn_1	Mean	C.D. (P = 0.05)	
Cu_0	32.34	38.62	35.48	Cu	2.03
Cu_1	35.04	51.33	43.18		
Mean	33.69	44.97	39.33	Zn x Cu	2.73
Fe x Cu					
Fe \ **Cu**	Cu_0	Cu_1	Mean		C.D. (P = 0.05)
Fe_0	32.63	40.47	36.55		
Fe_1	38.33	45.89	42.11		
Mean	35.48	43.18	39.33	Fe x Cu	NS
Zn x FexCu					
Zn Fe Cu	Zn_0 Fe_0	Zn_1 Fe_0	Zn_0 Fe_1	Zn_1 Fe_1	C.D. (P = 0.05)
Cu_0	32.18	33.08	32.51	44.16	Zn x Fe x Cu NS
Cu_1	33.70	47.25	36.38	55.41	

between Fe x Cu were found to be poor and non significant in this regard. Numerically maximum number of cormels was exhibited by F_1Cu_1 (45.89) followed by Fe_0Cu_1 (40.47). These findings are in supports of and Chen *et al.* (1) and Haldar *et al.* (3) in gladiolus.

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