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Effect of zinc and corm size on growth and corm yield in gladiolus (*Gladiolus* spp.)

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Abstract

An experiment was conducted at Banaras Hindu University, Varanasi, Uttar Pradesh, to find the effect of soil application of zinc sulphate and corm size on growth and corm parameters in gladiolus cv. Malaviya Kundan during 2018-19. The experiment was laid out in randomized block design replicated 4 times where mother corms of seven different sizes and zinc sulphate at three different levels were used. The largest-sized corm (4.0 cm) was found to be the best in growth characters like leaf length, scape width and number of leaves/plant. Application of zinc at various doses also provided positive response in days to sprouting and leaf length. Bigger- sized corms (3.0-4.0 cm) produced more no. of corms and cormels/hill, increased diameter and weight of corms compared to small size of mother corms (1.0-2.5 cm). All the doses of zinc sulphate failed to exert any significant effect on production of corms and cormels.

Key words: Corm grades, Zinc sulphate, Soil application, Plant growth, Corm, Yield.

Gladiolus (*Gladiolus* spp.), as a cut flower, is becoming popular day-by-day because of its magnificent inflorescence and availability of a wide range of colours (Singh, 2006, Swaroop *et al.*, 2019). Production of good quality floral spikes depends on vigorous vegetative growth and it is believed to be affected by the presence of micronutrients in soil in an ample quantity (Somkuwar *et al.*, 2023). Among all micronutrients, zinc (Zn) the meticulously regulates various metabolic processes in plants which helps to enhance growth (Hembrom and Singh, 2015), flower (Saeed *et al.*, 2013) and corm production (Singh and Singh, 2000). Application of ZnSO4 at 0.4% enhanced length and width of longest leaf and also improved weight of corms and cormels produced per hill with improved corm diameter in gladiolus (Hembrom *et al.*, 2015, Rocktim and Sunil, 2022). Application of zinc in gladiolus resulted in maximum number of cormels per hill whose weight was also influenced with the same (Singh *et al.*, 2015b). In the areas of Varanasi district, 46% of the soil was found deficient to zinc and higher content zinc found only in 17% soils (Singh *et al.*, 2013). In India, very little work has been done on soil application of zinc with the use of varying plant propagules in gladiolus. Keeping in view, a field trial was conducted to investigate the effect of zinc sulphate and corm grades on growth and corm yield in gladiolus cv. Malaviya Kundan.

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Materials and Methods

The experiment was conducted at Banaras Hindu University, Varanasi, Uttar Pradesh, India, during 2018-19. The experimental site is located around the centre of North- Gangetic alluvial plain at 25°15’ north latitude, 83°03’ east longitude and has an elevation of 129.23 metres above mean sea-level. The climate of Varanasi is humid-subtropical having dry summers as well as cold winters with the temperature ranging 22 to 46°C and annual rainfall around 998 mm per annum. Diseased-free and healthy corms of gladiolus cv. Malaviya Kundan of varying sizes, i.e. 1.0 cm, 1.5 cm, 2.0 cm, 2.5 cm, 3.0 cm, 3.5 cm and 4.0 cm were planted in beds sizing 3m × 2m with row-to-row 30 cm and corm-to-corm 20 cm during mid- November. Zinc sulphate (ZnSO4) was used at three different levels, i.e. control (no zinc), 15 kg/ha and 30 kg/ha and were incorporated in soil at the time of field preparation.

There were total 21 treatment combinations between corm grades and zinc sulphate. These treatments were replicated four times in randomized block design. The irrigation, weeding, earthing-up, plant- protection and staking were done whenever needed. The observations were recorded on growth and corm characters. Studied growth parameters were days taken to 50, 75 and 100% sprouting, leaf length, scape width, number of leaves/plant, whereas, yield/corm was counted as number of corms/hill, diameter of corms, weight of corms, number of cormels/

Table 1: Effect of corm grades and zinc sulphate on growth parameters such as days to sprouting, leaf length, scape width and number of leaves/plant in gladiolus var. Malaviya Kundan.

Treatment	Days to sprouting			Leaf length (cm)			Scape width (cm)			No. of leaves/plant		
	50%	75%	100%	40th DAP	60th DAP	80th DAP	40th DAP	60th DAP	80th DAP	40th DAP	60th DAP	80th DAP
Corm grades												
4.0 cm	10.63	11.62	16.66	34.83	36.92	41.37	1.91	2.72	2.88	4.02	7.47	7.47
3.5 cm	10.24	11.11	13.00	31.55	35.71	40.12	1.83	2.62	2.96	3.00	5.75	5.75
3.0 cm	9.93	11.52	17.33	26.79	31.03	36.99	1.73	2.52	2.97	2.79	5.58	5.58
2.5 cm	10.16	11.66	21.33	24.32	28.90	36.79	1.57	2.42	2.62	2.29	4.66	4.66
2.0 cm	11.70	14.00	22.33	23.82	27.01	33.61	1.64	2.80	2.91	2.06	4.12	4.12
1.5 cm	11.21	13.16	21.00	25.60	25.64	32.00	1.21	2.39	2.58	2.04	3.70	3.70
1.0 cm	12.94	14.02	15.36	20.96	24.67	26.35	0.60	1.38	1.49	1.14	2.39	2.39
C.D. (5%)	0.008	0.009	0.02	1.84	1.45	1.46	0.13	0.20	0.20	0.33	0.45	0.45
Zinc doses												
0 kg/ha (Control)	10.79	12.70	18.71	26.40	29.58	35.56	1.47	2.48	2.70	2.49	4.90	4.90
15 kg/ha	10.88	12.02	18.58	27.35	30.73	35.07	1.47	2.43	2.59	2.46	4.71	4.71
30 kg/ha	11.25	12.60	17.15	26.77	29.63	35.33	1.55	2.32	2.61	2.48	4.83	4.83
C.D. (5%)	0.005	0.006	0.01	NS	0.95	NS	NS	NS	NS	NS	NS	NS
Interaction (corm grade × zinc dose)												
4.0 cm × 0 kg/ha (Control)	10.56	11.00	13.00	35.45	37.12	41.30	1.89	2.66	2.72	3.87	7.56	7.56
4.0 cm × 15 kg/ha	10.85	13.00	20.00	35.59	37.01	41.53	1.97	2.77	2.89	3.93	7.25	7.25
4.0 cm × 30 kg/ha	10.50	10.86	17.00	33.46	36.63	41.28	1.87	2.74	3.02	4.25	7.62	7.62
3.5 cm × 0 kg/ha (Control)	10.90	11.79	14.00	30.14	35.46	40.72	1.85	2.61	3.00	3.18	6.06	6.06
3.5 cm × 15 kg/ha	10.83	11.25	12.00	34.28	37.07	39.16	1.79	2.64	3.05	3.06	5.62	5.62
3.5 cm × 30 kg/ha	9.00	10.30	13.00	30.24	34.60	40.46	1.86	2.62	2.85	2.75	5.56	5.56
3.0 cm × 0 kg/ha (Control)	10.30	11.57	19.00	25.37	29.83	37.57	1.74	2.49	3.01	2.75	5.93	5.93
3.0 cm × 15 kg/ha	9.00	11.00	18.00	26.92	33.84	36.45	1.71	2.65	2.78	2.56	5.37	5.37
3.0 cm × 30 kg/ha	10.50	12.00	15.00	28.09	29.42	36.94	1.73	2.42	3.13	3.06	5.43	5.43
2.5 cm × 0 kg/ha (Control)	8.80	11.00	22.00	25.40	29.47	37.52	1.57	2.60	2.73	2.50	4.62	4.62
2.5 cm × 15 kg/ha	10.00	11.00	20.00	24.03	27.53	35.76	1.56	2.64	2.69	2.25	4.62	4.62
2.5 cm × 30 kg/ha	11.70	13.00	22.00	23.54	29.71	37.07	1.57	2.02	2.44	2.12	4.75	4.75
2.0 cm × 0 kg/ha (Control)	12.00	15.00	23.00	23.49	25.84	33.04	1.36	3.10	3.22	2.06	4.06	4.06
2.0 cm × 15 kg/ha	10.80	12.00	20.00	25.43	28.24	33.91	1.50	2.54	2.66	2.00	4.06	4.06
2.0 cm × 30 kg/ha	12.30	15.00	24.00	22.56	26.95	33.88	2.06	2.76	2.85	2.12	4.25	4.25
1.5 cm × 0 kg/ha (Control)	11.00	15.00	25.00	23.11	23.76	31.29	1.39	2.41	2.71	1.81	3.56	3.56
1.5 cm × 15 kg/ha	10.88	11.50	23.00	26.07	25.91	33.09	1.16	2.44	2.54	2.31	3.81	3.81
1.5 cm × 30 kg/ha	11.75	13.00	15.00	27.62	27.25	31.62	1.09	2.33	2.49	2.00	3.75	3.75
1.0 cm × 0 kg/ha (Control)	12.00	13.60	15.00	21.85	25.57	27.46	0.51	1.47	1.50	1.25	2.50	2.50
1.0 cm × 15 kg/ha	13.80	14.40	17.00	19.11	25.56	25.56	0.61	1.32	1.49	1.12	2.25	2.25
1.0 cm × 30 kg/ha	13.00	14.00	14.00	21.91	22.89	26.05	0.69	1.36	1.47	1.06	2.43	2.43
C.D. (5%)	0.014	0.03	0.03	3.19	2.51	NS	0.22	NS	NS	NS	NS	NS

hill, weight of cormels/hill. The statistical analysis (ANOVA) was performed as per Assaad *et al.* (2014).

Results and Discussion

Various growth characters were significantly influenced by the corm grades and soil application of zinc in gladiolus (Table 1). Minimum days required for 50% sprouting was found with corm grade 3.0 cm (9.93 days), zinc at 0 kg/ha, i.e., control (10.79 days) as well as in interaction between grade 2.5 cm × $ZnSO_4$ 0 kg/ha (8.80 days). The 75% and 100% sprouting were achieved earliest in corm grade 3.5 cm (11.11 and 13 days respectively). Whereas, $ZnSO_4$ application at 15 kg/ha and the interaction of grade 4.0 cm × $ZnSO_4$ 0 kg/ha showed the earliest 75% sprouting in the field.

The application of $ZnSO_4$ at 30 kg/ha took minimum days to 100% sprouting (17.14 days). Leaf length was maximum in largest corm grade used for planting which was statistically at par with grade 3.5 cm. Whereas, among zinc doses lower dose, i.e., 15 kg/ha showed maximum leaf length at 60 days after planting (DAP) (30.73 cm). Corm grade 4.0 cm was responsible for maximum scape width at 40 DAP (1.91 cm) and 60 DAP (2.72 cm) which is also statistically at par with grade 3.5 cm. Effect of zinc sulphate was non-significant on this growth parameter.

Among interaction effects, grade 2.0 cm × $ZnSO_4$ 30 kg/ha was the best over other interactions. Total number of leaves/plant was maximum in largest corm grade (4.0 cm) at all 40, 60 and 80 DAP (4.02, 7.47 and 7.47 cm, respectively), whereas, it was minimum in smallest corm grade (1.0 cm) used for planting (Table 1). The effect of zinc was non-significant on the same. The improvement in growth might be due to the presence of micronutrient (zinc) which activates several enzymes in plants which ultimately regulates various metabolic and physiological processes. These findings are in agreement with those of Singh *et al.* (2012), Singh *et al.* (2015a) and Hembrom *et al.* (2015). The application of $ZnSO_4$ at 0.5% enhanced growth parameters (Devi *et al.*, 2017).

Ara *et al.* (2015) and Singh *et al.* (2017) also found similar results with the application of zinc in gladiolus and obtained positive response to plant height, number of leaves/plant. The positive effect of corm grades on growth of plants might be due to amount of food/carbohydrate stored in mother corms. In larger corm, more amount of carbohydrate is stored, hence, the larger-sized corm might have provided maximum vegetative growth as compared to smaller grades. Present findings are in line with those of Bhande *et al.* (2015).

The response of various corm grade was observed to assess corm attributes under uniform management

Table 2: Effect of corm grades and zinc sulphate on corm parameters such as number of corms, cormels/hills, diameter of corm, weight of corm and weight of cormels in gladiolus var. Malaviya Kundan.

Treatment	No. of corms/ hill	No. of cormels/ hill	Diameter of corm (cm)	Weight of corm (g)	Weight of cormels/hill (g)
Corm grades					
4.0 cm	1.89	42.16	35.48	16.68	0.15
3.5 cm	1.18	46.13	39.65	24.70	0.18
3.0 cm	1.06	52.72	39.81	22.05	0.15
2.5 cm	1.11	38.65	39.05	19.81	0.16
2.0 cm	1.00	27.17	32.83	13.04	0.20
1.5 cm	1.00	23.62	30.73	11.49	0.16
1.0 cm	1.00	18.71	23.93	7.50	0.15
C.D. (5%)	0.21	9.47	3.66	3.32	NS
Zinc doses					
0 kg/ha (Control)	1.20	33.04	33.59	15.47	0.16
15 kg/ha	1.12	37.86	36.08	17.54	0.17
30 kg/ha	1.21	35.88	33.82	16.39	0.17
C.D. (5%)	NS	NS	NS	NS	NS

situation. Maximum number of corms/hill (1.89) was produced from a single mother corm was highest in largest corm grade (4.0 cm). Cormels produced per plant was maximum in corm grade 3.0 cm (52.72). Whereas, number of corms and cormels were minimum in small-sized grades. Diameter of corm was maximum in corm grade 3.0 cm (39.81 cm) and it was also statistically at par with grade 3.5 and 2.5 cm. Weight of corm was maximum in grade 3.5 cm (24.70 g) which is also statistically at par with grade 3.0 cm (22.05 g). Effect of zinc sulphate on all the corm parameters was found non-significant. These findings are in close conformity with those of Memon *et al.* (2009) and Kamal *et al.* (2013). Joshi *et al.* (2011) also found similar results in which largest-sized corms performed better with respect to number of corms and cormels produced from a single mother corm of gladiolus.

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