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Propagule Size and Zinc Application influenced flowering in gladiolus cv. Malaviya Kundan

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ABSTRACT: Zinc is one of the essential micronutrients to the plants having antioxidant properties which eventually help in enhancing the quality and vase life of flowers. But usually the application of micronutrients is neglected all over the world. Therefore, supply of adequate amount of nutrients at proper time is imperative for achieving quality flowers for export to the international market. The present research effort aims to elucidate the response of gladiolus cv. Malaviya Kundan to different concentrations of zinc sulphate for obtaining better flowering trait. An experiment was conducted at Horticulture Research Farm, Banaras Hindu University, Varanasi. Experiment was consisted seven grades of corms (1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0 cm) with three levels of zinc (0, 15.0 and 30.0 kg/ha) which was laid out in Randomized Block Design (RBD) and replicated 4 times. Parameters like days to spike emergence, days to colour show, days to opening of floret, diameter and length of floret, spike length, rachis length, number of florets per spike and number of opened florets, longevity of floret and duration of flowering were taken into consideration to assess the effect of propagule size and zinc. The results revealed that corm grade 3.5 cm achieved significant results on most of the flowering indices including length of 3rd and 5th floret, duration of flowering, number of florets, number of opened florets, spike length and rachis length followed by grade 4.0 cm. Various doses of zinc produce significant effect on flowering parameters. $ZnSO_4$ at 15kg/ha was found beneficial for most of the flowering parameters in gladiolus i.e. early emergence of spike, early colour show, days to opening of 1st floret, duration of flowering, number of opened florets, spike length and rachis length. Interaction effect between corm grade and zinc was found to be non-significant for all the flowering parameters.

Keywords: Zinc sulphate, soil application, corm grades, flower diameter, flowering duration.

INTRODUCTION

Gladiolus is an herbaceous annual flowering crop which belongs to the family Iridaceae. It is an economically important cut flower in both domestic and international market because of its availability round the year (Chanda *et al*., 2000). This magnificent flower is commonly referred as the 'Queen of bulbous flowers' because of its fascinating flower spike which contains massive florets of brilliant colours, appealing shapes, varying sizes and excellent shelf life (Singh and Sisodia 2017). This flower is very popularly grown in India for its multiple spike forms which is available in varying floret colours and is very adventitious in every floral arrangement, bedding and exhibition (Singh, 2006). Production of good quality floral spikes depends on the size of plant propagule and application of micro-nutrients in adequate quantity. Inadequate plant nutrient status in plants causes serious disorders and may eventually lead to decline of plant growth and poor flowering characters of the plant. Among all essential micro nutrients, zinc is a crucial element in respect of plant growth which is well established for the activities like synthesis of protein, synthesis of auxin (IAA) and the formation of RNAase (Rashid, 2005). It also regulates various metabolic processes in plants which ultimately helps to enhance the plant growth and flower production (Sarwar *et al*., 2012). Application of zinc found beneficial in flower crops like *Lilium* (Asmita and Singh 2015; Asmita *et al*., 2015) and gladiolus (Hembrom *et al*., 2015; Singh *et al*., 2015a). An optimum dose of application of micro-nutrients will not only ensure better quality of gladiolus with an improved yield but also led to minimum wastage of the applied micro-nutrients. This study was, however, carried out to evaluate the effect of corm size and zinc sulphate on various flowering indices of gladiolus cv. Malaviya Kundan.

MATERIALS AND METHODS

The present investigation was carried out at Horticulture Research Farm, Department of Horticulture, Banaras Hindu University, Varanasi, Uttar Pradesh, India. The site where investigation was done is geographically located around the centre of North-Gangetic alluvial plain (on the left bank of river Ganga)

at around 25°15′ north latitude, 83°03′ east longitude at an elevation of 129.23 meters above mean sea level (MSL). The climate here is humid subtropical having large variation between summer and winter temperature. Temperature of this region varies in the range of 22 to 46°C with an average annual rainfall of 998 mm per annum. Experiment was consisted of seven grades of plant propagule (corms) of gladiolus cv. Malaviya Kundan (1.0 cm, 1.5 cm, 2.0 cm, 2.5 cm, 3.0 cm, 3.5 cm and 4.0 cm) and three levels of zinc sulphate ($ZnSO_4$)i.e. control (no zinc), 15 kg/ha and 30 kg/ha which was incorporated in soil at the time of field preparation and mixed thoroughly. These treatments were replicated four times in Randomized Block Design (RBD). Clean and healthy corms were selected and planted in the beds sizing 3.0×2.0 m at the spacing of row to row 30 cm and corm to corm 20 cm in the middle of November. Required management practices like irrigation, weeding, hoeing, earthing up, plant protection and staking were done whenever needed. The observations on each treatment were recorded on flowering characters. Studied flowering parameters were days to spike emergence, days to colour show, days to opening of floret, longevity of florets, floret diameter and length, number of total florets and opened florets per spike and duration of flowering. Results obtained from the study were subjected to statistical analysis.

RESULTS AND DISCUSSION

Response of corm grade and zinc sulphate at different concentrations were recorded to affect the flowering behaviour under uniform management condition. The application of zinc and corm grade significantly influenced the various flowering indices when compared to control. Smallest corm grade (1.0 cm) used for planting exhibited no flowering probably due to small size and less stored food i.e. carbohydrates, etc. Days taken to emergence of spike in the field (Table 1) was recorded minimum in the largest corm grade i.e. 4.0 cm (90.36 days), which was maximum in grade 1.5 cm (96.29 days). Among zinc treatments, earliest spike emergence was observed in $ZnSO_4$ at 15 kg/ha (92.05 days). Whereas, it was latest in $ZnSO_4$ at 30 kg/ha. The significant effect of zinc sulphate and corm grade was also observed for the days required to colour show (Table 1). Earliest colour show stage was observed in the largest corm grade (100.81 days), which was minimum in grade 2.0 cm (106.40 days). Among zinc doses, zinc at 15 kg/ha was found beneficial in respect of days to colour show (102.59 days), whereas, it was delayed in control plants (104.12 days). Days to opening of 1st, 3rd and 5th floret was maximum in corm grade 4.0 cm (104.59, 105.74, 106.92 days) which was statistically at par with grade 3.5 cm. Maximum days to opening of florets were recorded in grade 1.5 cm. Among zinc treatments, $ZnSO_4$ at 15 kg/ha resulted in earliest opening of 1st floret (106.52 days) which was latest in control plants (108.73 days). Effect of corm grade and zinc was non-significant on the longevity of 1st, 3rd and 5th florets and diameter and length of last floret. Longevity of last floret was significantly affected by zinc treatment (Table 1) which was found to be maximum in control (3.07 days) and was statistically at par with zinc at 15 kg/ha (2.98 days). Parameters such as, early spike emergence, early colour show, early opening of floret, floret longevity found to be significantly affected by the application zinc and corm grade. This might be due to the fact that zinc helps in accumulating more assimilates which are needed for growth and development of spike. Similar results were also found by Ara *et al*. (2015); Singh *et al*. (2015b) in gladiolus, Munikrishnappa *et al*. (2002) in tuberose and Singh *et al*. (2018) ; Hussain *et al*. (2020) in marigold. Longevity of 1st and 2nd flower was increased with application of Zn 0.2% in *Lilium* (Asmita and Singh 2015).

Table 1: Effect of corm grades and zinc sulphate on days to spike emergence, days to colour show, days to opening of floret and longevity of floret in gladiolus var. Malaviya Kundan.

Treatment	Days to spike emergence	Days to colour show	Days to opening of floret			Longevity of floret (days)			
			1st floret	3rd floret	5th floret	1st floret	3rd floret	5th floret	Last floret
Corm grades									
4.0 cm	90.36	100.81	104.59	105.74	106.92	2.39	2.56	2.77	3.22
3.5 cm	90.57	100.84	104.79	105.86	107.34	2.64	2.65	2.84	2.81
3.0 cm	92.71	102.83	107.31	107.63	108.93	2.20	2.41	2.90	2.90
2.5 cm	93.19	104.24	108.11	109.50	110.91	2.58	2.50	2.58	3.03
2.0 cm	95.56	106.40	110.35	111.45	112.59	2.32	2.43	3.13	2.73
1.5 cm	96.29	106.06	110.97	112.35	113.88	2.49	2.61	2.73	2.90
1.0 cm	-	-	-	-	-	-	-	-	-
C.D. at 5%	1.87	1.80	2.43	2.48	2.61	NS	NS	NS	NS
Zinc doses									
0 kg/ha (Control)	93.41	104.12	108.73	109.89	111.28	2.43	2.47	2.92	3.07
15 kg/ha	92.05	102.59	106.52	107.69	109.05	2.34	2.58	2.64	2.98
30 kg/ha	93.87	103.88	107.81	108.69	109.94	2.54	2.54	2.91	2.75
C.D. at 5%	1.32	1.27	1.72	NS	NS	NS	NS	NS	0.23

The diameter and the length of florets determines the beauty of the spike. Larger the diameter and length of the floret, more attractive the floral spike is. In present study, corm grade 2.5 cm (10.01, 9.73, 9.37 cm) resulted in maximum diameter of 1st, 3rd and 5th florets which was also significantly at par with grade 3.0 cm, 4.0 cm and 3.5 cm, respectively (Table 2). Length of floret was significantly affected only with the corm grades and not by zinc treatments. Length of 1st floret was maximum in corm grade 3.0 cm (10.65 cm). The length of 3rdand 5thfloret was maximum in grade 3.5 cm (10.44, 10.32 cm, respectively). Length of all 1st, 3rd and 5th floret was found minimum in smaller grade, i.e. 1.5 cm. Whereas, diameter and length of the last floret was not affected with the application of zinc and corm grade. Above flowering indices were absolutely affected by the use of varying size of mother corms used. This might be caused due to the reason that larger corms store higher amount of food in it as compared to the smaller ones. Therefore, larger corm grades have produced significant response on the flowering attributes of the gladiolus. These results are in congruence with the findings of Dilta *et al*. (2004); Bhat and Khan (2007); Bhande *et al*. (2015) who worked in gladiolus and found significant response of corm grades on flowering attributes.

Table 2: Effect of corm grades and zinc sulphate on diameter and length of floret in gladiolus var. Malaviya Kundan.

Treatment	Diameter of floret (cm)				Length of floret (cm)			
	1st floret	3rd floret	5th floret	Last floret	1st floret	3rd floret	5th floret	Last floret
Corm grades								
4.0 cm	9.81	9.57	8.82	7.21	10.47	10.28	9.91	8.56
3.5 cm	9.71	9.72	9.15	7.78	10.47	10.44	10.32	8.91
3.0 cm	9.89	9.32	9.23	7.51	10.65	10.42	10.25	8.51
2.5 cm	10.01	9.73	9.37	7.50	10.60	10.34	10.10	8.54
2.0 cm	9.33	9.00	8.47	7.46	10.17	10.13	9.53	8.97
1.5 cm	9.10	8.85	8.64	7.53	9.86	9.65	9.51	8.88
1.0 cm	-	-	-	-	-	-	-	-
C.D. at 5%	0.57	0.51	0.44	NS	0.49	0.48	0.50	NS
Zinc doses								
0 kg/ha (Control)	9.62	9.28	8.84	7.56	10.14	10.01	9.84	8.64
15 kg/ha	9.69	9.45	9.13	7.48	10.56	10.30	10.12	8.79
30 kg/ha	9.62	9.36	8.87	7.45	10.41	10.32	9.85	8.76
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS

Number of florets produces per spike is a parameter for the judgment of quality of spike. In gladiolus, the florets are one directional and as such a greater number of florets per spike enhance the beauty and quality of the spike. The data presented in Table 3 indicate that the number of total florets and opened florets per spike was significantly affected by the use of corm grade. Number of total florets and opened florets per spike was maximum in corm grade 3.5 cm (14.42 and 13.34, respectively) which was significantly at par with corm grade 4.0 cm and 3.0 cm. Days taken to the withering of last floret was influenced by both corm grade and zinc treatment. Maximum days were taken for the withering of last floret was observed in smaller grade i.e. 1.5 cm (110.98 days) which was statistically at par with grade 2.0 cm (110.45 days). This might have caused due to the flowering in smaller grades was found to commence later as compare to larger grades. Among zinc treatments, control plants took maximum days to withering of last floret, where it was statistically at par with $ZnSO_4$ at 30 kg/ha (107.43 days). This might be happened due to involvement of zinc in the synthesis of plant hormones. Spike length was found to be the maximum in corm grade 3.5 cm (79.92 cm). The effect of zinc was non-significant on the length of spike which was still maximum in zinc at 15 kg/ha (63.11 cm). Maximum rachis length was observed in corm grade 3.5 cm (46.21 cm) which was also statistically at par with grade 3.0 cm (41.95 cm) and grade 4.0 cm (41.74 cm). Total duration of flowering in gladiolus was positively affected by the use of corm grades (Table 3) which was maximum in grade 3.5 cm (12.22 days). It was also found to be statistically at par with corm grade 4.0 cm (12.07 days), grade 3.0 cm (11.49 days) and grade 2.5 cm (11.48 days) respectively. Zinc treatment produced non-significant results in respect of length of spike, length of rachis and duration of flowering. However, in Asiatic lily it was noticed that early flowering, maximum flower stalk length and pedicel length increased due to application of zinc (Asmita *et al*., 2015). The enhanced flowering indices observed with the application of various corm grades might be due to the reason that larger corms store more amount of carbohydrates which produced significant response on the flowering attributes of the gladiolus. These results are in agreement with the findings of Kumar and Yadav (2006); Kamal *et al*. (2013); Bhande *et al*. (2015) who observed significantly improved flowering characters with increasing size of mother corm in gladiolus. In an experiment maximum solution uptake and vase life were recorded with application of zinc in *Lilium* (Asmita and Singh 2015).

Table 3: Effect of corm grades and zinc sulphate on no. of florets per spike, no. of opened florets per spike, days to withering of last floret, length of spike, length of rachis and duration of flowering in gladiolus var. Malaviya Kundan.

Treatment	No. of florets/spike	No. of opened florets/spike	Withering of last floret (days)	Length of spike (cm)	Length of rachis (cm)	Duration of flowering (days)
Corm grades						
4.0 cm	13.67	12.62	104.42	72.36	41.74	12.07
3.5 cm	14.42	13.34	104.79	79.92	46.21	12.22
3.0 cm	13.50	12.38	106.61	63.97	41.95	11.49
2.5 cm	12.36	11.41	108.20	56.09	38.12	11.48
2.0 cm	10.81	10.15	110.45	52.66	34.49	10.44
1.5 cm	9.76	9.22	110.98	48.73	31.57	10.26
1.0 cm	-	-	-	-	-	-
C.D. at 5%	1.07	1.19	2.42	6.53	5.02	1.08
Zinc doses						
0 kg/ha (Control)	12.28	11.31	108.74	60.80	38.33	11.04
15 kg/ha	12.52	11.68	106.56	63.11	39.77	11.68
30 kg/ha	12.47	11.58	107.43	62.95	38.95	11.26
C.D. at 5%	NS	NS	1.71	NS	NS	NS

CONCLUSIONS

On the basis of the experimental findings it maybe concluded that the application of $ZnSO_4$ at 15 kg/ha was found beneficial on most of flowering parameters. However, among various grades largest corm grade i.e. 4.0 cm was found to be the best for most flowering parameters followed by grade 3.5 cm and 3.0 cm, respectively.

FUTURE SCOPE

Gladiolus growers will find appropriate size of propagule (corm) and dose of zinc for more production of quality flowers of newly developed gladiolus variety Malaviya Kundan.

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Conflict of Interest. None.

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