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Influence of plant growth regulators on growth and corm yield of *Gladiolus grandiflorus* L.

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Abstract
A field experiment was conducted during rabi season of 2020-21 at the Organic Research Farm, Karaguanji, Bundelkhand University, Jhansi (U.P.) To study the influence of plant growth regulators on growth and corm yield of *Gladiolus*. The results revealed that the plant growth regulators (GA_3 and CCC) significantly influenced the growth and corm production of *Gladiolus*. The maximum plant height, minimum days for spike initiation, long length of spike, number of spikes per plant and per hectare, spike weight and rachis length were found significantly superior with the foliar application of GA_3 (200 ppm). Whereas foliar application of CCC (200 ppm) gave superior results regarding number of corms per plant and per hectare, weight of corms and cormels per plant, diameter of corm, number of cormerls per plant and per hectare. Hence, on the basis of results obtained from the present investigation, it can be concluded that the foliar application of GA_3 (200 ppm) was found the most effective with respect to vegetative growth and spike characters, while CCC (200 ppm) was found the most effective with respect to different characters of corm and cormels as well as net return/ha from *Gladiolus*. Hence CCC (200 ppm) can be recommended to the farmers for commercial cultivation and with maximum economical gain from *Gladiolus* (Rose supreme).

Keywords: Plant growth regulators, corm yield, *Gladiolus*

Introduction
Gladiolus grandiflorus L. is one of the most popular flowers and its cultivation has become a commercially remunerative preposition for cut flowers. *Gladiolus* is very much liked for its majestic spikes with florets of massive forms, attractive colours and varying shape and size. Gibberellic acid (GA_3) is a very potent plant growth substance and its application at very low concentrations can have a profound effect. The beneficial effect of GA_3 on ornamental plant is well known and gaining popularity among the growers. Gibberellins increase number of leaves per plant, number of spikes per plant, number per spike and height of plant as well as corm production in *Gladiolus* (Baskaran *et al*. 2009) [3]. Hormones have been used for production of large attractive flower and long lasting blossoms. Synthetic growth regulating chemicals were reported to be very effective in manipulating growth, flowering and corm production in *Gladiolus*. Gibberellins have pronounced effect on vegetative growth, yield and quality of flowers (Dubey *et al.* 2010) [1, 2], Cytokinins are to promote lateral bud and cell division, cell and organ development synthesized in leaf and root tips. Benzyl Adenine (BA) is commonly used for multiplication of shoots and causes beneficial effect on growth and flower production. Keeping above facts in view the present study was taken up.

Materials and Methods
The field experiment was carried out during rabi season of 2020-21 at the Organic Farm, Bundelkhand University, Jhansi (U.P.). The soil of the experimental field was sandy loam having pH 7.4, E.C. 0.60 dS/m, organic carbon 0.48 %, available N, P and K 212, 14 and 185 kg/ha, respectively. The experiment was conducted in randomized block design with 9 treatments comprising 2 levels of GA_3 (150 & 200 ppm) with and without CCC (150 & 200 ppm) replicated thrice. *Gladiolus* corms of uniform size were planted in 1x1 m beds on 30 Oct. 2020 at a distance of 30 x 30 cm with 7 cm deep. Well rotten FYM @ 4 kg was applied to each bed and then mixed in the soil thoroughly 10 days before planting. Irrigation, weeding and earthing up operations were done as per recommended package of practices. GA_3 and CCC solutions of the specified concentrations were foliar sprayed 40 days after planting. Periodical observations were recorded with respect to growth and floral characters as well as corm production.

Results and Discussion

Growth and spike characters: The data in Table 1 revealed that the plant height increased significantly (86 cm) with the highest concentration of GA_3 up to 200 ppm. This was followed by GA_3 150 ppm. Where as in case of control treatment the height was only 76 cm. The beneficial influence of GA_3 may be owing to increased photosynthetic efficiency on account of stabilization of chlorophyll (Faraji and Baskai, 2013). The beneficial influence of GA_3 on growth parameters has also been documented by Montassori *et al*. (2013) and Padmalatha *et al*. (2014) [4, 6].

The days required for spike initiation in *Gladiolus* shortened significantly as a result of increased concentration of GA_3 up to 200 ppm (T_2). This was followed by GA_3 150 ppm (T_1). This way be owing to decreased vegetative growth phase with increased photosynthates. The same treatments T_2 and then T_1 also encouraged spike parameters up to significant extent over the remaining treatments. According the spike length was 96.21 cm, spikes 2.9 /plant, spikes 32.2 lakhs/ha, spike weight 50.1 g and rachis length 46.1 cm. This might be attributed to mobilization and movement of nutrients as well as mobilization of auxins and metabolites into flowers (Sajid *et al*. 2015) [3, 7].

Table 1: Growth and spike characters of *Gladiolus* as influenced by plant growth regulators

Treatments		Plant height (cm)	Days taken for spike initiation	Length of spike (cm)	Spikes /plant	Spikes lakhs/ha	Spike weight (g)	Rachis length (cm)	Corms/ plant	Corms weight/ plant (g)
T_0	Control	75.94	121.0	70.00	1.20	13.33	33.68	41.33	1.00	25.47
T_1	GA_3 150 ppm	85.15	91.5	95.65	2.50	27.78	48.89	45.50	1.01	25.99
T_2	GA_3 200 ppm	86.07	83.1	96.21	2.90	32.22	50.10	46.10	1.25	27.70
T_3	CCC 150 ppm	77.28	112.8	73.40	1.70	18.89	35.68	42.83	1.75	36.09
T_4	CCC 200 ppm	77.00	119.7	70.65	1.50	16.67	33.87	42.20	1.91	39.68
T_5	GA_3 150 ppm + CCC 150 ppm	83.86	101.7	93.90	2.20	24.44	45.91	44.97	1.59	33.19
T_6	GA_3 150 ppm + CCC 200 ppm	81.14	109.7	89.99	2.00	22.22	42.92	44.77	1.66	35.27
T_7	GA_3 200 ppm + CCC 150 ppm	83.32	100.6	94.00	2.30	25.56	46.65	45.50	1.39	28.27
T_8	GA_3 200 ppm + CCC 200 ppm	82.78	109.3	91.70	2.10	23.33	44.86	44.77	1.49	30.28
	S.Em$\pm$	0.474	0.625	0.575	0.210	1.083	0.508	0.433	0.144	0.495
	C.D. (5%)	0.671	0.884	0.813	0.297	2.296	0.719	0.612	0.204	0.701

Floral Characters: The data in Table 2 apparently indicate that the application of CCC up to 200 ppm encouraged the floral characters of *Gladiolus* significantly as compared to GA_3 or GA_3 + CCC treatments. Accordingly the maximum corms were 1.91/plant, corms weight 39.68/plant, corm diameter 7.14 cm, cormels 26.65/plant and cormels weight 5.9 g/plant. The second best treatments were CCC @ 150 ppm. The increased floral characters may be due to increased physiological processes, root and shoot growth, flowering and nucleic acid synthesis as well as increased translocation of photosynthates towards sink. Similar results have also been reported by Joshi *et al.* (2012) [4, 8], Padmalatha *et al.* (2013) [9, 10] and Chopde *et al*. (2015) [7, 5].

Table 2: Floral characters, yield and economics from *Gladiolus* as influenced by plant growth regulators

Treatments		Corm diameter (cm)	Cormels/plant	Cormels wt./plant (g)	Corm yield lakhs/ha	Cormels yield lakhs/ha)	Net return (Rs/ha)	B:C ratio
T_0	Control	5.32	11.03	2.96	1.11	12.26	334600	1.51
T_1	GA_3 150 ppm	5.40	15.17	4.54	1.12	16.86	353472	1.71
T_2	GA_3 200 ppm	6.09	15.57	4.94	1.39	17.30	440596	1.73
T_3	CCC 150 ppm	6.95	24.04	5.82	1.95	26.71	619288	1.74
T_4	CCC 200 ppm	7.14	26.65	5.96	2.12	29.61	774636	2.70
T_5	GA_3 150 ppm + CCC 150 ppm	6.66	22.35	5.66	1.77	24.83	380049	0.76
T_6	GA_3 150 ppm + CCC 200 ppm	6.82	23.23	5.74	1.84	25.81	718938	0.83
T_7	GA_3 200 ppm + CCC 150 ppm	6.21	17.37	5.52	1.54	19.30	291404	0.61
T_8	GA_3 200 ppm + CCC 200 ppm	6.39	19.78	5.54	1.66	21.98	249181	0.73
	S.Em$\pm$	0.137	0.369	0.235	0.158	0.185	-	-
	C.D. (5%)	0.194	0.522	0.332	0.224	0.262	-	-

Corm production and economics: Application of CCC up to 200 ppm (T_4) resulted in significant enhancement of corm yield (2.12 lac/ha) and comels yield (29.61 lac/ha), consequently net return up to Rs. 774636/ha with 2.70 B:C ratio. The second best treatment was CCC @ 150 ppm (T_3) where the corm yield was 1.95 lac/ha, cormels yield 26.71 lac/ha and net return Rs. 619288/ha with 1.74 B:C ratio. The significant effect of CCC (200 ppm) may be owing to the better growth modification and proper utilization of the nutrients which produced the maximum floral characters of the *Gladiolus* plant. The CCC manufactured sufficient amount of carbohydrate during photosynthesis which ultimately translocated to the sink. Similar results have also been reported by Sharma *et al.* (2008) [9, 10], Joshi *et al.* (2012), Sajid *et al.* (2015) [8, 9, 10] and Chopde *et al*. (2015) [9, 10].

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