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EFFECT OF PLANT GROWTH REGULATORS ON GROWTH AND SPIKE YIELD OF GLADIOLUS CULTIVARS

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ABSTRACT: The field experiment was conducted during Rabi season 2010-2011 with combination of different sources of plant growth regulators to study their effect on vegetative growth and spike yield of gladiolus. Experiment consisted of 16 treatments each replicated thrice and laid out in RBD. The results obtained showed that the plant growth regulators significantly affected the growth parameters of gladiolus such as maximum values of plant height (80.78cm and 82.22cm in Novalux and White Prosperity, respectively), number of shoots in Novalux and White Prosperity (3.44 in each), number of leaves /plant (20.78 and 20.44 in Novalux and White Prosperity, respectively), minimum days to spike initiation in Novalux (76.67days) and in White Prosperity (78 days), minimum days to opening of the first floret (81.67 days in Novalux and 88.67 days in White Prosperity), first florets durability (7.56 days in Novalux and 7.11 days in White Prosperity), spike length (81.55cm in Novalux and 82.00cm in White Prosperity), number of florets/spike (23.67 in Novalux and 18.33 in White Prosperity), number of spikes/plant (3.67 in Novalux and 3.11 in White Prosperity) and spike yield /ha (295200 in Novalux and 279900 in White Prosperity). The maximum value of yield and yield attributing parameters were found to be higher under the treatment NAA @ 200ppm (T_9).

Keywords: *CCC, GA_3, NAA, gladiolus, spike, yield.*

Gladiolus is very popular and important bulbous ornamental flowering plant of the world. It is known as queen of bulbous flowers. It belongs to the family Iridaceae and is a native of Mediterranean region. It is excellent for cut flower as it lasts long in flower vase and has magnificent inflorescence with variety of colour. Suitable variety for the region is one of the important factors influencing the yield and quality of gladiolus spikes and corms. The growth and development of plant is governed by internal factors namely hormonal and nutritional balance. The balanced development of plant is governed by the growth regulators, which are being increasingly used to manipulate the growth and flowering of ornamental plants. Therefore, the present study was undertaken to find out the suitable variety of gladiolus for the region and concentration of the growth regulators like gibberellic acid, naphathelein acetic acid and cycocel for the better growth, flowering and corm production of gladiolus.

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MATERIALS AND METHODS

This experiment was conducted in Floriculture Unit, Department of Horticulture, Allahabad School of Agriculture, SHIATS, Allahabad during 2010-2011. Soil of the experimental plot was sandy loamy, uniform in texture and well drained. FYM was applied @ 25 t ha^{-1} at the time of land preparation. The experiment was laid out in Randomized Block Deign (RBD) with three replications. Treatments comprised of three plant growth regulators each having five levels *viz*. CCC @ 300, 600, 900, 1200, 1500ppm, NAA @ 50,100,150,200, 250 ppm and GA_3 @ 50,100,150,200,250 ppm along with a control (only tap water). The cold stored gladiolus cv. Novalux and White Prosperity corms of above 5.5 cm diameter were purchased from Vatika Nursery, Bad Shah Nagar, Lucknow and placed at room temperature for 15 days. The shade dried corms were planted at a spacing 30x30 cm in raised beds of 2x2m dimensions.

The plants were sprayed with aquous solution of the growth regulators as per treatments schedule at 30th and 45th and 60th day after planting. The intercultural operations were followed as and when required. The growth and yield parameters of both cultivars for each treatment were observed in three plants selected by random sampling method. The data were statistically analyzed and critical differences were worked out at five per cent level to draw statistical conclusions as suggested by Panse and Sakhatme (8).

RESULTS AND DISCUSSION

The results summarized in Table 1 revealed that the maximum plant height (80.78cm) of Novalux was recorded with the treatment of GA_3@150ppm (T_{13}) followed by T_9 (200 ppm NAA, 80.11cm) and the minimum plant height (65.00cm) was noticed with control. While, in case of cultivar White Prosperity, the maximum plant height (82.22cm) was recorded with NAA@200ppm (T_9) followed by T_8 and T_{11}, and the minimum plant height (64.67cm) was noticed with control. These findings are in consonance with the reports of Awasthi *et al.* (1), Chopde *et al.* (3), Kumar *et al.* (4) and Sharma *et al.* (11) in gladiolus. The maximum number of shoots/plant (3.44) in variety Novalux was recorded under NAA@200ppm and GA_3@100ppm (T_9 and T_{12} each) followed by T_{13} and T_4, and the minimum number of shoots/plant (1.67) was noticed in control. In the same year in cultivar White Prosperity, maximum number of shoots/plant (3.44) was recorded under NAA@250ppm followed by T_8, T_7 and T_{15}, and the minimum number of shoots (1.78) was noticed with control. The findings are in consonance with the reports of Kumar *et al.* (4) and Umrao *et al*. (12) in gladiolus. In variety Novalux and White Prosperity, the maximum number of leaves per plant (20.78 and 20.44, respectively) was recorded under NAA@200ppm followed by T_{13} and T_{12}, and the minimum number of leaves per plant (13.33 and12.56 in Nova Lux and White Prosperity, respectively) was noticed with control. These findings are in consonance with the reports of Awasthi *et al.* (1), Chopde *et al.* (3), Kumar *et al.* (4) and Sharma *et al.* (11) in gladiolus and Kumar *et al.* (5) in carnation. The minimum days to 50% spike initiation (76.67 days in Novalux and 78.00 days in White Prosperity) was recorded with the NAA @ 200ppm treatment, while maximum days to 50% spike initiation (89.00 days) was noticed with control in Novalux and 84.00 days in White Prosperity with NAA @ 250 ppm. This may be attributed to optimum vegetative growth which resulted earlier shift to respective phase and reduced juvenile phase. Earliness in spike initiation due to GA_3 application was also reported by Mishra *et al.* (6**)** in gladiolus**.** The minimum days to opening of the first florets (81.67 and 88.67 days in Novalux and White Prosperity, respectively) was recorded with the treatment NAA@200ppm (T_9) followed by T_{13} and T_2, and the maximum days to opening of the first florets was noticed with control (92.67 days in Novalux) and with T_1 (93.00days in White Prosperity). The findings are in agreement with the reports of Kumar *et al.* (4). The maximum durability of first florets in Novalux and White Prosperity (7.56 and 7.11 days, respectively) was recorded under NAA@200ppm (T_9) and the minimum durability of first floret in both the varieties (5.00 and 5.33 days, respectively) was noticed with control. Umrao *et al.* (12) had also been reported same trends of spike durability due to use of plant growth regulators in gladiolus. The maximum spike length (81.55 cm) in Novalux was recorded under NAA@ 200 ppm, while in White Prosperity, the maximum spike length (82.00cm) was recorded under GA_3@150 ppm (T_{13}) followed by T_8 and T_{14}. The minimum spike length in both the varieties (68.44 and 74.44cm, respectively) was noticed with control.

Table 1: Effect of plant growth regulators on growth parameters of gladiolus cultivars at 90 days after transplanting.

PGR Conc.	Plant height (cm) at 90 days		No. of shoot at 90 days		No. of leaves per plant at 90 days		Days to 50% spike initiation		Days to opening of the first floret		First florets durability		Spike length in cm		Number of florets/spike	
	Noval ux	White Prosperity	Noval ux	White Prosperity	Noval ux	White Prosperity	Noval ux	White Prosperity	Noval ux	White Prosperity	Noval ux	White Prosperity	Noval ux	White Prosperity	Novalux	White Prosperity
Control (T_0)	65.00	64.67	1.67	1.78	13.00	12.56	89.00	84.00	92.67	92.67	5.00	5.33	68.44	74.44	14.89	15.33
300ppm CCC(T_1)	71.56	66.33	3.11	2.67	16.44	17.67	81.67	82.33	90.67	93.00	5.67	5.89	76.33	74.89	16.89	17.11
600ppm CCC(T_2)	66.22	66.89	2.67	2.89	19.00	19.44	84.67	78.67	82.67	90.00	5.44	6.22	74.89	76.78	15.33	17.22
900ppm CCC(T_3)	72.33	67.22	2.78	2.56	13.33	17.33	79.00	82.67	91.67	91.00	5.00	6.44	76.89	78.89	16.67	16.44
1200ppm CCC(T_4)	67.78	70.44	3.22	2.56	14.67	17.11	78.00	81.33	90.00	91.00	6.56	6.33	73.44s	78.11	16.78	16.33
1500ppm CCC(T_5)	70.33	68.78	2.33	2.78	17.56	17.33	78.67	81.33	89.00	90.00	5.56	5.67	69.89	78.00	15.22	15.33
50ppm NAA(T_6)	68.44	67.89	2.22	2.89	15.22	16.22	79.67	83.67	89.00	92.33	5.11	5.67	70.22	77.44	16.67	15.89
100ppm NAA(T_7)	71.78	70.33	2.44	3.11	17.11	17.00	80.33	83.33	91.00	91.00	5.67	6.22	70.44	77.22	16.44	16.44
150ppm NAA(T_8)	67.67	75.11	1.89	3.11	16.22	17.33	83.67	82.33	90.67	90.67	6.11	6.00	70.22	81.00	16.78	17.00
200ppm NAA(T_9)	80.11	82.22	3.44	2.44	20.78	20.44	76.67	78.00	81.67	88.67	7.56	7.11	81.55	78.33	23.67	17.00
250ppm NAA(T_{10})	70.78	71.22	2.44	3.44	17.78	15.56	82.67	84.00	91.67	89.67	5.56	6.11	75.44	77.89	16.00	18.78
50ppm NAA(T_{11})	68.00	72.33	2.00	2.56	15.00	18.00	85.67	84.00	90.67	89.33	5.67	6.78	73.11	78.89	18.00	17.33
100ppm NAA(T_{12})	67.11	66.78	3.44	2.44	18.44	14.78	77.33	82.33	91.33	91.67	5.00	6.89	77.67	76.22	15.56	17.67
150ppm NAA(T_{13})	80.78	71.44	3.22	2.44	20.44	19.56	82.33	82.00	82.00	88.67	7.56	6.56	72.67	82.00	19.11	16.33
200ppm NAA(T_{14})	64.33	67.89	2.67	2.44	17.89	16.67	82.33	82.00	88.33	92.67	6.33	6.67	74.11	77.11	15.11	16.56
250ppm NAA(T_{15})	72.67	69.44	2.56	3.00	15.56	15.56	81.33	83.33	87.00	92.33	5.89	6.89	74.22	80.44	16.78	17.22
F-test	S	S	1.67	1.78	S	S	S	NS	S	S	S	S	NS	NS	S	S
C.D.(P=0.05)	5.29	4.99	3.44	2.89	3.27	3.51	4.55	5.39	3.17	1.88	0.82	0.47	8.90	6.98	1.51	1.62

Table 2: Effect of plant growth regulators on yield parameters of gladiolus cultivars at 90 days after transplanting.

Treatments	Yield Parameters							
	Number of spikes/plant		No. of corms per plant		Spike yield /ha (Nos.)		Corm yield /ha (Nos.)	
	Novalux	White Prosperity	Novalux	White Prosperity	Novalux	White Prosperity	Novalux	White Prosperity
Control(T_0)	1.56	1.63	1.67	1.73	129600	140400	135000	144900
300ppm CCC(T_1)	2.78	2.67	2.67	2.67	250200	230400	244800	230400
600ppm CCC(T_2)	3.22	2.22	3.11	2.22	2799000	240300	275400	234900
900ppm CCC(T_3)	2.56	2.56	2.78	2.44	230400	244800	240300	234900
1200ppm CCC(T_4)	3.11	2.78	3.56	2.78	254700	244800	275400	244800
1500ppm CCC(T_5)	2.11	2.56	2.33	2.44	215100	244800	225000	240300
50ppm NAA(T_6)	2.67	2.67	2.11	2.89	240300	234900	216900	244800
100ppm NAA(T_7)	2.89	2.56	2.44	2.22	264600	240300	244800	219600
150ppm NAA(T_8)	2.67	2.78	1.89	2.56	240300	264600	205200	254700
200ppm NAA(T_9)	3.67	3.11	3.44	3.11	295200	279900	315000	275400
250ppm NAA(T_{10})	2.56	2.33	2.44	2.33	216010	230400	234900	234900
50ppm NAA(T_{11})	2.33	2.11	2.00	2.11	215100	225000	199800	209700
100ppm NAA(T_{12})	2.56	3.11	2.78	3.00	225000	279900	289800	260100
150ppm NAA(T_{13})	3.33	3.00	3.22	2.67	289800	234900	270000	234900
200ppm NAA(T_{14})	2.33	2.67	2.67	2.44	219600	260100	234900	240300
250ppm NAA(T_{15})	2.56	2.44	2.56	2.22	240300	244800	240300	230400
F-test	S	S	S	NS				
C.D.(P=0.05)	0.84	0.39	0.96	0.76				

The maximum number of florets per spike in Novalux (23.67) was recorded under NAA@200ppm while in case of White Prosperity, the maximum number of florets/spike (18.78) was noticed under NAA@250ppm. Minimum number of florets per spike in Novalux and White Prosperity (14.89 and 15.33, respectively) was noticed under control treatment. These quality parameters of flowers with the use of MH @1000 ppm were at par with control. Present findings are in consonance with those of Barman and Rajani (2), Chopde *et al.* (3) Pal and Chowdhary (7) and Patel *et al.* (9) in gladiolus. The maximum number of spikes per plant (Table 2) in Novalux and White Prosperity (3.67 and 3.11, respectively) was recorded under the treatment of NAA@200ppm, and control treatment exhibited the minimum number of spikes per plant (1.56 and 1.63, respectively) in both the varieties. These results are in accordance with findings of Patel *et al.* (9) in gladiolus and Ragaa (10) in Irish. Application of plant growth regulators had also exhibited significant influences on number of daughter corms/plant

where CCC @ 1200ppm produced significantly maximum corms/plant (3.56) in Novalux followed by NAA@200ppm (3.44 corms/plant), while in case of White Prosperity, growth regulators' application could not showed any significant influence in increasing corm numbers confirming to reports of Umrao *et al.* (12). This might be due to influence of growth retardants in delaying floral initiation, which would have enhanced source to sink ratio by reducing the partition of carbohydrates to vegetative and reproductive phase which is evident from the increase in daughter corm numbers due to CCC application when compared to control. It is clear from Table 2 that the maximum spike yield /ha in both the varieties (295200 and 279900, respectively) was recorded with NAA @ 200 ppm treatment, while the minimum spike yield of 129600/ha and 140400/ha was noted control in Novalux and White Prosperity, respectively. Like the production of spikes per unit area, corm production (315000 corms and 275400 corms/ha) was also higher with NAA@200ppm in both the varieties.

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