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Effect of Plant Growth Regulators on Sprouting, Vegetative Characters, Flowering and Corm Production in *Gladiolus*sp. cv. Sancerre

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ABSTRACT

The present investigation was carried out to study the effect of plant growth regulators on sprouting, vegetative characters, flowering and corm production in Gladiolussp. cv. Sancerre at the Experimental Farm of Horticulture Department, CCS HAU, Hisarduring 2014-2015. Corms were dipped overnight in the solution of BAP (25, 50 and 100 ppm), GA_3 (200, 300 and 400ppm) and NAA (400, 500 and 600 ppm) including water dipping as control. The gladiolus corms in NAA treatment could not germinate. Minimum days taken for sprouting of corms (12.96 days), maximum sprouting percentage (95.83%), maximum number of florets per spike (14.41) and maximum length of spike (56.11 cm) was found in GA_3 300 ppm treatment whereas maximum plant height (48.25 cm), number of spikes per plant (1.89), diameter of basal floret (9.93 cm), duration of flowering (16.21 days), weight of corm per plant (28.59 g) and diameter of corm (6.03 cm) was observed maximum in GA_3 400 ppm. BAP significantly increased the number of corms per plant, whereas number (14.01) and weight of cormels per plant (4.09g) were recorded maximum in GA_3 200 ppm.

Key words: *Gladiolus, Growth regulators, Corm, Benzyl Adenine Purine, Gibberelic Acid.*

INTRODUCTION

Gladiolus is a flower of glamour and perfection, known as the queen of bulbous flowers due to its flower spikes with florets of massive form, brilliant colours, attractive shapes, varying size and excellent shelf life. The name gladiolusis derived from the Latin word ‘gladius’ or ‘gladiator’ because of its sword-like leaves. It is popularly known as sword lily. It was introduced into cultivation at the end of the 16th century[13]. Gladiolus is one among the most popular cut flowers in India. The agro-ecological conditions of the country are very conducive for its survival and culture as a crop. It is mainly cultivated for cut-flowers because of its elegant appearance and prolonged vase life. Gladiolus spikes are most popular in flower arrangements and for preparing attractive bouquets[11]. The magnificent inflorescence with various colors has made it attractive for use in herbaceous borders, beddings, rockeries, pots and for cut-flowers.

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Normal plant growth and development is regulated by naturally produced chemicals or phytohormones. Their role can often be substituted by application of synthetic growth regulating chemicals. These are becoming extremely important and valuable in the commercial control of crop growth in both agriculture and horticulture[7]. Gibberellic Acid (GA_3) has been used to increase the height of plants, number of flowers and induce early flowering[17]. The most pronounced effect of gibberellins on the plant growth is the elongation of the internodes. The primary physiological effect of auxin is cell division and cell elongation in the shoots. Application of optimum level of growth regulators may not only ensure better yield and quality of gladiolus, as well as minimum wastage of growth regulators. Keeping in view the role of plant growth regulators on various morphological and floral attributes of gladiolus, present investigation was carried out to find out the appropriate concentration of plant growth regulators for better growth and flowering in gladiolus.

MATERIAL AND METHODS

The present investigation was carried out during 2014-15 at the Experimental farm, Department of Horticulture, Chaudhary Charan Singh Haryana Agricultural University, Hisar. Uniform sized corms (3.5 - 4.0 cm) of cultivar Sancerre were used in this experiment. There were 10 treatments *viz*; BAP (Benzyl Adenine Purine (25, 50 and 100 ppm), GA_3 (Gibberelic Acid) (200, 300 and 400 ppm), NAA (Naphthalene Acetic Acid) (400, 500 and 600 ppm) and control. Each treatment replicated was thrice in Randomized Block Design (RBD). Corms were soaked for overnight in the respective treatments. The treated corms were planted at spacing of 30 cm x 30cm and a depth of 5 to 7cm in a plot of 1.2 x 1.2 m^2size. Regular weeding was done to check growth of the weeds. Earthing up was done 30 days after planting to provide sufficient soil volume for the spread of cormels, better aeration and to prevent lodging. Irrigation was given at 15 days interval throughout the growing period. Irrigation was withheld fifteen days before lifting of corms. Staking was done at the time of spike emergence to prevent breaking and bending of spikes due to their own weight or strong wind. The analysis of variance was done by using RBD at 5% level of significance (P=0.05).

RESULTS AND DISCUSSION

Sprouting

In general, dipping of corms overnight in NAA gave poor (negligible) sprouting and the survival of such plants was nil. It might be due to high concentration of NAA coupled with longer duration of dipping *i.e*. overnight dipping, therefore further observations could not be made under NAA treatment. GA_3treatment resulted in significant and early sprouting of corms (Table 1). The minimum days taken for sprouting (12.96 days) were observed in corms treated with $GA_3$300 ppm which was at par with GA_3 400 ppm (13.04 days) and $GA_3$200 ppm (13.28 days) whereas maximum days taken for sprouting was recorded in 100 ppm BAP treatment (20.75 days).This might be through alteration of hormonal balance in the favour of promoters. Another hypothesis is that, free GA_3 is active in breaking down the reserve food material by hydrolytic enzymes which might have resulted in quick sprouting. These results are in conformity with the earlier reports of promotion effects of GA_3 on the sprouting of corms[4,8,9,10].

GA_3 significantly decreased duration of sprouting and also increased sprouting percentage as compared to control whereas corms treated with BAP took maximum duration of sprouting. The maximum sprouting percentage (95.83%) and minimum duration of sprouting (15.33 days) was recorded in GA_3 300 ppm and $GA_3$400 ppm treatment, respectively, whereas minimum sprouting percentage (75.00%) and maximum duration of sprouting (23.17 days) was recorded in BAP 100 ppm treatment. Increase in sprouting percentage by GA_3 treatment was in accordance with the work of Kumar *et al.*[10] and Kumar *et al*[8].

Vegetative Characters

Data presented in Table 1 shows that plantheight increased significantly with GA_3 treatment. The maximum plant height (48.25 cm) at 90 days after planting was obtained with GA_3 400 ppm which was at par with GA_3 300 ppm (47.60 cm) and GA_3 200 ppm (47.46 cm) while minimum was recorded in BAP 100 ppm treatment (37.11 cm). This is due the fact that application of Gibberellic acid increases cell division and cell elongation in plants resulting in more number of cells and increase in cell length which ultimately affects plant growth[17]. These results are in close agreement with the findings of Sharma *et al.*[16], Ramachandrudu and Thangam[15] and Dogra *et al.*[5] in gladiolus. The number of leaves per plant was not statistically significant as compared to control. Similar result was also observed by Ramachandrudu and Thangam[15] in gladiolus. However it is contrary to the reports by Sharma *et al.*[16] and Dogra*et al.*[5] who found that GA_3 increased the number of leaves per plant in gladiolus.

Floral Parameters

The data presented in Table2 depicts that the days taken for initiation of spike and opening of basal floret were significantly reduced by GA_3 treatment as compared to control. The minimum number of days taken for spike initiation (87.13 days) and opening of basal floret (123.66 days) was observed in 400 ppm GA_3 treatment which was at par with $GA_3$300 ppm (88.04 and 124.06 days, respectively) and $GA_3$200 ppm (88.68 and 126.02 days respectively) whereas maximum days taken for initiation of spike and opening of basal floret were recorded in 100 ppm BAP treatment (98.99 and 136.36 days, respectively) which was at par with BAP 50 ppm (97.51 and 136.00 days, respectively). Treatment of GA_3 might have stimulated and enhanced the vegetative growth, increased photosynthesis and respiration with enhanced CO_2 fixation in the treated plants which would have associated with an early flowering. Further gibberellin is quite effective in reducing juvenile period of plants. These results are corroborated with the finding of Ramachandrudu and Thangam[15], Baskaran and Misra[2], Havale*et al.*[6] and Kumar *et al*[8].

The number of spikes per plant (except GA_3 200 ppm) increased significantly with GA_3 treatment. Maximum number of spikes per plant was observed in GA_3 400 ppm treatment (1.89) which was at par with GA_3 300 ppm (1.79), whereas minimum number of spikes per plant was observed in 100 ppm BAP (1.01). The length of spike also increased significantly with GA_3 treatment. Maximum spike length was observed in GA_3 300 ppm treatment (56.11 cm) which was at par with GA_3 400 ppm (55.57 cm) and GA_3 200 ppm (54.84 cm) whereas minimum spike length was recorded in BAP 50 ppm (44.53 cm) followed by BAP 100 ppm (45.28 cm). This may be due to the fact that gibberellic acid enhances cell elongation and ultimately elongated the spike. Similar results were given by Sharma *et al.*[16], Bhalla and Kumar[3], Havale*et al.*[6] and Kumar *et al*[8].

GA_3 significantly increased the diameter of basal floret (except GA_3 200 ppm) and duration of flowering whereas BAP decreased both the parameters as compared to control. Maximum diameter of basal floret was recoded in GA_3 400 ppm (9.93 cm) which was at par with GA_3 300 ppm (9.18 cm) while it was recorded minimum in BAP 25 ppm (7.01 cm), similarly maximum duration of flowering was observed in GA_3 400 ppm treatment (16.21 days) followed by GA_3 300 ppm (15.71 days) and GA_3 200 ppm (15.30 days) while it was minimum in BAP 100 ppm treatment (11.61 days). The increase in duration of flowering could be due to more amount of reserve food present in spikes treated with GA_3. Sharma *et al.*[16] and Ramachandrudu and Thangam[15] also reported increase in floret diameter and flowering duration with GA_3 treatment.

Corm and Cormel Parameters

In general, number of corms in plants increased when treated with BAP as compared to control (Table 3). Maximum number of corms was produced in BAP 100 ppm treatment (2.48) which was at par with BAP 50 ppm (2.24) and BAP 25 ppm treatment

(2.17) whereas it was recorded minimum in 400 ppm GA_3 treatment (1.35). Gladiolus has two competing sinks, flower spike or inflorescence and developing corm and cormels. BAP at different concentrations promoted the sink activity of developing corm and cormels at the expense of flower spike or inflorescence. This might be the reason for increase in number of replacement corms and poor quality of spikes. Similar results were also observed by Ram *et al.*[14], Barman and Rajni[1] and Kumar *et al*.[8] in gladiolus. Weight of corm and diameter of corm was significantly increased by GA_3 400 ppm and 300 ppm. The maximum weight of corms per plant (28.59 g) and diameter of corm (6.03 cm) was recorded in GA_3 400 ppm treatment which was at par with GA_3 300 ppm (27.65 g and 5.04 cm, respectively) whereas it was recorded minimum in 100 ppm BAP treatment (17.70 g and 3.18 cm, respectively). The increase in size and weight of corms with the application of GA_3 can be attributed to its ability to increase the leaf area which in turn increased the photosynthetic assimilates. These assimilates are transported to the resulting daughter corms, thereby, increasing their size and weight. These results are in conformity with the earlier reports of Sharma *et al.*[16], Bhalla and Kumar[3], Dogra*et al.*[5] and Padmalatha*et al*[12].

The number of cormels and weight of cormels was significantly affected by GA_3. Maximum number and weight of cormels was recorded in GA_3 200 ppm (14.01and 4.09 g, respectively) followed by GA_3 300 ppm (13.73and 3.73 g, respectively). The above observations are in conformity with the findings of Bhalla and Kumar[3] and Dogra *et al.*[5] who reported that GA_3 200 ppm and 300 ppm significantly increased the number and weight of cormels per plant in gladiolus.

Table 1: Effect of plant growth regulators on sprouting and vegetative characters of gladiolus

Treatment	Days taken for sprouting of corms	Duration of Sprouting (days)	Sprouting (%)	Plant height at 90 DAP (cm)	No. of leaves per plant
T1 - BAP 25ppm	17.32	19.33	79.17	40.28	7.08
T2 - BAP 50ppm	18.88	20.00	83.33	39.30	7.08
T3 - BAP 100ppm	20.75	23.17	75.00	37.11	7.30
T4 - GA_3 200ppm	13.28	16.50	93.75	47.46	7.90
T5 - GA_3 300ppm	12.96	16.00	95.83	47.60	7.76
T6 - GA_3 400ppm	13.04	15.33	89.58	48.25	7.58
T10 - control	15.82	17.17	87.67	43.51	7.47
S.E (m)±	0.48	0.45	4.34	0.42	0.27
C.D. (5%)	1.50	1.40	13.52	1.30	NS

* Sprouting was negligible and the survival of plants was nil in NAA treatment

Table 2: Effect of plant growth regulators ondifferent floral parameters of gladiolus

Treatment	Days taken for initiation of spike	Days taken for opening of basal floret	No. of spikes per plant	Length of Spike (cm)	Diameter of basal floret (cm)	Duration of flowering (days)
T1 - BAP 25ppm	95.33	135.33	1.28	47.61	7.01	13.15
T2 - BAP 50ppm	97.51	136.00	1.09	44.53	7.50	12.79
T3 - BAP 100ppm	98.99	136.36	1.01	45.28	8.15	11.61
T4 - GA_3 200ppm	88.68	126.02	1.65	54.84	8.83	15.30
T5 - GA_3 300ppm	88.04	124.06	1.79	56.11	9.18	15.71
T6 - GA_3 400ppm	87.13	123.66	1.89	55.57	9.93	16.21
T10 - control	91.56	129.00	1.39	51.69	7.98	12.93
S.E (m)±	0.48	0.72	0.09	0.51	0.31	0.24
C.D. (5%)	1.50	2.25	0.29	1.58	0.95	0.74

Table 3: Effect of plant growth regulators on corm and cormel parameters of gladiolus

Treatment	No. of corms per plant	Weight of corm (g)	Diameter of corm (cm)	No. of cormels per plant	Weight of cormelsper plant(g)
T1 - BAP 25ppm	2.17	23.45	3.70	12.63	2.07
T2 - BAP 50ppm	2.24	21.55	4.02	13.03	2.96
T3 - BAP 100ppm	2.48	17.70	3.18	13.17	3.00
T4 - GA_3 200ppm	1.81	26.06	4.61	14.01	4.09
T5 - GA_3 300ppm	1.75	27.65	5.04	13.73	3.73
T6 - GA_3 400ppm	1.35	28.59	6.03	13.44	3.16
T10 - control	1.56	24.30	4.12	12.78	2.69
S.E (m)±	0.18	0.71	0.26	0.18	0.19
C.D. (5%)	0.57	2.22	0.81	0.56	0.59

CONCLUSION

Based on one year of investigation it is concluded that early sprouting of corms was observed in all GA_3 treatments. Plant height, number of spikes per plant, diameter of basal floret, duration of flowering, weight of corm per plant and diameter of corm was observed maximum in GA_3 400ppm. Sprouting percentage, number of florets per spike and length of spike was found to be maximum in GA_3 300 ppm treatment. BAP significantly increased the number of corms per plant, whereas number of cormels and weight of cormels per plant was recorded maximum in GA_3 200 ppm treatment.

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