Andhra Pradesh J Agril. Sci : 2(4): 301-306, 2016

EFFECT OF PLANT GROWTH REGULATORS ON DORMANCY AND FLOWERING IN GLADIOLUS *(Gladiolus grandiflorus* L.)

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Date of Receipt: 01-10-2016 Date of Acceptance: 12-12-2016

ABSTRACT

Studies were conducted on the effect of plant growth regulators on dormancy and flowering in gladiolus cvs. American Beauty and White Prosperity during *rabi* 2009. The plant growth regulators, Gibberellic acid (GA_3) at 75, 100 and 125 ppm, Benzyl Adenine (BA) at 25, 50 and 100 ppm, Naphthalene Acetic Acid (NAA) at 50, 100 and 150 ppm were used for this study. Gladiolus corms were dipped in the plant growth regulator solutions for a period of 10 hours before planting. Cultivar American Beauty with GA_3 at 125 ppm recorded less number of days to sprout (17.00) and 50 per cent sprouting (29.00) of gladiolus corms. All the plant growth regulator treatments at higher concentrations recorded less number of days to sprouting and 50 per cent sprouting of gladiolus corms. GA_3 at 125 ppm recorded highest percentage of sprouting (100.00) in both the cultivars. Among the plant growth regulator treatments, cv. American beauty in combination with NAA at 150 ppm recorded less number of days to first floret appearance (70.00), 50 per cent flowering (80.67) and number of days to first flower spike harvest (75.33). BA at 100 ppm recorded maximum number of spikes per corm in cv. American beauty (1.67). Cultivar White Prosperity in combination with GA_3 at 125 ppm recorded significantly higher mean spike length (65.00 cm) as well as maximum number of florets per spike (11.33).

KEYWORDS: Gladiolus, Gibberellic acid, Naphthalene Acetic Acid, Benzyl Adenine, dormancy, flowering

INTRODUCTION

Gladiolus (*Gladiolus grandifloras* L.) is a bulbous cut flower of beauty and perfection. It is popularly known as 'Queen of the bulbous flowers' because of attractive spikes, having florets of different colours and longer keeping quality. Gladiolus is very popular for its wide open, good texture and impressive colored spikes which are of great demand in both domestic and international market. Gladiolus is commercially propagated by corms. Poor multiplication rate and presence of dormancy for 3-4 months in corms restricts their immediate use in the following season resulting in high cost of corms and is often higher than the sale price of flower spike produced by the corm. Dormancy of corm and cormel is one of the major hindrance in the commercial cultivation of Gladiolus. The physiological basis of corm and cormel dormancy has been ascribed to the accumulation of growth inhibiting substances, especially Abcissic acid (ABA) in the tissue as well as in the scales encapsulating them. In many of the cultivars, it is possible to regulate morphogenic processes successfully with physiologically active compounds to shorten natural dormancy and control flowering dates (Ganyushkin, 1991). The plant growth regulators play an important role in production of quality corms and cormels in gladiolus (Bhattacharjee, 1984). The present investigation is aimed to reduce the dormancy period of freshly harvested corms and improve their flowering, quality corm and cormel production by treating the corms with various plant growth regulators at different concentrations.

MATERIAL AND METHODS

Effect of plant growth regulators on dormancy and flowering in gladiolus cvs. American Beauty and White Prosperity were studied during *rabi* 2009. The plant growth regulator treatments, Gibberellic acid (GA_3) at 75, 100 and 125 ppm, Benzyl Adenine (BA) at 25, 50 and 100 ppm and Naphthalene Acetic Acid (NAA) at 50, 100 and 150 ppm were used for this experiment. The corms were soaked in the solutions for a period of 10 hours before planting after removal of corm scales. There were 20 treatments each replicated thrice in Randomized Block Design with factorial concept. The data was analyzed using computer software programmed by the method of variance outlined by Panse and Sukhatme (1985).

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RESULTS AND DISCUSSION

In the present study, cultivar American Beauty has taken significantly minimum number of days for sprouting of corms and days taken to 50 per cent sprouting of corms over cv. White Prosperity (Table 1), which indicated that number of days taken to sprouting is a genetic character of cultivar. Cultivar American Beauty recorded significantly minimum number of days to earlier sprouting (22.08 days) and 50 per cent sprouting of corms (33.85 days) than cv. White Prosperity (23.60 days and 35.53 days respectively). Highest percentage of sprouting (82.30) of corms was recorded in cv. White Prosperity followed by cv. American Beauty (80.40). Genotypic variation in respect of days to sprouting and per cent sprouting was reported earlier by Seenivasan (2001) in gladiolus.

In general, the study indicated that the plant growth regulator treatments (GA_3, NAA and BA) at higher concentrations recorded less number of days for sprouting over the lower concentrations (Table- 1). The treatment GA_3 at 125 ppm recorded less number of days both for early sprouting (17.66 days) and 50 per cent sprouting of corms (29.50days).However, control recorded maximum number of days to early sprout (26.66days) and 50 per cent sprouting of corms (39.08days). GA_3 at 125 ppm recorded significantly maximum percentage of sprouting (100.00) over other treatments.

Though, GA_3 effect is not exactly determined, early sprouting of corms in treatment with GA_3 might be through alteration of hormonal balance in favour of promoters or through promotion of alternate respiration. 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 and cormels (Kumar *et al.,* 2008). In breaking the dormancy of gladiolus corms, Gibberellic acid and Benzyl adenine were more effective. Breaking of dormancy in gladiolus has been linked to ethylene production. Ginzburg (1973) reported that ethepon promoted the growth of dormant corms, and application of BA induced ethylene production. Promotional effect of BA was reported by Ram *et al.* (2002) in gladiolus cv. Friendship. Among the plant growth regulators, NAA with all the concentrations recorded maximum number of days for corm sprouting. Similar results were reported by Kirad *et al.* (2001) in gladiolus cv. Friendship.

A perusal of the data presented, significant influence of cultivars, plant growth regulators, and their interaction on number of days taken for first floret opening, 50% flowering, number of spikes, spike length, number of florets per spike and days to first harvest (Table 2 and 3).

Earliest first floret appearance (79.56 days), minimum number of days to 50 percent flowering (91.40days) and days to first harvest (83.16days) was observed in cv. American beauty. Among the plant growth regulator treatments, minimum number of days for first floret appearance (80.00days), 50 percent flowering (91.33days), and days to first harvest (85.16days) was recorded with NAA at 150 ppm where as control recorded maximum number of days for first floret appearance, 50 per cent flowering and days to first harvest (97.00 days, 108.33 days and 101.67 days respectively)(Table2 and 3). In gladiolus the differentiation of the inflorescence from the apex occurs after the full number of leaves has been initiated. In the present experiment, all the treatments, which recorded higher leaf area during early stages of growth flowered earlier. Among the plant growth regulators, NAA promoted earliness in flowering however GA_3 treatments delayed the flowering. Activity of GA_3 to delay flowering correlates with effectiveness for promoting stem elongation (King *et al.,* 1993). Among different levels of GA_3, the higher dose (125ppm) resulted in the earliest spike emergence in gladiolus cv. Congo song (Vijai Kumar and Singh 2005).

There was no significant difference in cultivars on number of spikes per corm. The cultivar American beauty produced more number of spikes per corm (1.33) over cv. White prosperity (1.30). Among the plant growth regulator treatments BA at 100 ppm recorded maximum number of spikes per corm (1.64) where as control recorded minimum number of spikes per corm (1.07)(Table 2). The increased number of flower spikes with BA treatments might be due to sprouting of more buds per corm and their capacity to produce spike. Cultivar White prosperity recorded maximum spike length (56.25 cm) over cv. American beauty (53.48 cm). GA_3 at 125 ppm recorded significantly higher mean spike length (63.83 cm), followed by GA_3 at 100 ppm (62.35 cm). Minimum spike length was observed with BA at 25 ppm (47.91 cm). GA_3 at different concentrations significantly increased mean spike length. The increased spike length with GA_3 might be due to rapid internodal elongation as a result of increased cell division and cell elongation in the intercalary meristem. Plant growth regulators such as

Table 1. Effect of pre planting plant growth regulator treatments of Gladiolus corms on number of days taken to sprouting, 50 per cent sprouting and per cent sprouting in cultivars American Beauty and White Prosperity

Treatments	Number of days taken to sprouting			Number of days taken to 50 per cent sprouting			Per cent sprouting		
	A.B	W. P	Mean	A.B	W. P	Mean	A.B	W. P	Mean
Gibberellic acid (75 ppm)	22.66	24.00	23.33	34.50	35.00	34.75	80.00	82.00	81.00
Gibberellic acid (100 ppm)	18.33	20.33	19.33	29.66	32.16	30.91	88.00	90.00	89.00
Gibberellic acid (125 ppm)	17.00	18.33	17.66	29.00	30.00	29.50	100.00	100.00	100.00
Benzyl Adenine (25 ppm)	22.16	25.33	23.75	33.50	37.33	35.41	69.00	72.00	70.50
Benzyl Adenine (50 ppm)	20.66	22.33	21.50	32.00	34.16	33.08	72.00	74.00	73.00
Benzyl Adenine (100 ppm)	20.00	22.00	21.00	31.66	33.83	32.75	86.00	88.00	87.00
Naphthalene Acetic Acid (50 ppm)	26.00	27.00	26.50	37.66	39.00	38.33	70.00	72.00	71.00
Naphthalene Acetic Acid (100 ppm)	25.00	25.66	25.33	37.33	38.50	37.91	74.00	77.00	75.50
Naphthalene Acetic Acid (150 ppm)	23.00	23.66	23.33	35.00	35.33	35.16	80.00	82.00	81.00
Control	26.00	27.33	26.66	38.16	40.00	39.08	85.00	86.00	85.50
MEAN	22.08	23.60		33.85	35.53		80.40	82.30	
C.D at 5%									
Cultivars (C)		0.31			0.30			1.50	
Treatments (G)		0.69			0.68			3.37	
Interaction (C × G)		0.98			0.96			4.77	

A.B- American Beauty
W.P- White Prosperity

Table 2. Effect of pre planting plant growth regulator treatment of Gladiolus corms on number of days taken to first floret appearance, days taken to 50% flowering and number of spikes per plant in cultivars American Beauty and White Prosperity

Treatments	Number of days taken to first floret appearance			Number of days taken to 50% flowering			Number of spikes per plant		
	A.B	W. P	Mean	A.B	W. P	Mean	A.B	W. P	Mean
Gibberellic acid (75 ppm)	86.00	106.00	96.33	96.67	118.33	107.50	1.05	1.16	1.10
Gibberellic acid (100 ppm)	81.00	102.00	91.50	92.00	114.00	103.00	1.25	1.21	1.23
Gibberellic acid (125 ppm)	77.66	99.33	88.50	90.33	110.00	100.16	1.41	1.22	1.32
Benzyl Adenine (25 ppm)	82.33	102.33	92.33	95.00	111.00	103.00	1.40	1.33	1.36
Benzyl Adenine (50 ppm)	80.33	97.00	88.66	90.00	107.33	98.66	1.46	1.37	1.42
Benzyl Adenine (100 ppm)	77.66	95.00	86.33	89.33	105.00	97.16	1.67	1.62	1.64
Naphthalene Acetic Acid (50 ppm)	80.00	105.00	92.50	92.67	118.00	105.33	1.15	1.09	1.12
Naphthalene Acetic Acid (100 ppm)	75.00	95.00	85.00	86.33	104.67	95.50	1.36	1.31	1.33
Naphthalene Acetic Acid (150 ppm)	70.00	90.00	80.00	80.67	102.00	91.33	1.48	1.59	1.54
Control	85.66	108.33	97.00	101.0	116.67	108.83	1.09	1.05	1.07
MEAN	79.56	100.00		91.40	110.70		1.33	1.30	
			C.D at 5%						
Cultivars (C)		3.35			2.84			N.S.	
Treatments (G)		7.51			6.35			0.14	
Interaction(C × G)		N.S.			N.S.			N.S.	

A.B- American Beauty
W.P- White Prosperity

Table 3. Effect of pre planting plant growth regulator treatments of Gladiolus corms on spike length (cm), number of florets per spike and days taken to first harvest in cultivars American Beauty and White Prosperity

Treatments	Spike length (cm)			Number of florets per spike			Days taken to first harvest		
	A.B	W. P	Mean	A.B	W. P	Mean	A.B	W. P	Mean
Gibberellic acid (75 ppm)	56.00	56.66	56.33	9.86	10.40	10.13	89.66	111.66	100.33
Gibberellic acid (100 ppm)	61.00	63.50	62.35	10.47	11.00	10.73	84.66	107.33	96.00
Gibberellic acid (125 ppm)	62.66	65.00	63.83	10.63	11.33	11.00	82.66	102.33	92.50
Benzyl Adenine (25 ppm)	47.33	48.50	47.91	9.00	8.93	8.96	85.66	106.00	95.83
Benzyl Adenine (50 ppm)	50.13	52.06	51.10	9.30	10.16	9.73	84.66	103.66	94.33
Benzyl Adenine (100 ppm)	55.50	57.16	56.33	9.50	10.00	9.75	82.00	99.95	90.97
Naphthalene Acetic Acid (50 ppm)	47.66	50.00	48.83	8.88	9.200	9.04	85.33	108.00	96.66
Naphthalene Acetic Acid (100 ppm)	51.00	52.66	51.83	9.20	10.00	9.60	80.33	98.33	89.33
Naphthalene Acetic Acid (150 ppm)	51.66	54.33	53.00	9.40	10.10	9.75	75.33	95.00	85.16
Control	51.83	52.66	52.25	9.00	9.400	9.20	90.33	113.00	101.67
MEAN	53.48	56.25		9.53	10.05		83.16	104.30	
			C.D at 5%						
Cultivars (C)		0.055			0.36			3.71	
Treatments (G)		0.124			0.80			8.31	
Interaction(C × G)		N.S.			N.S.			11.7	

A.B- American Beauty
W.P- White Prosperity

GA_3 promotes vegetative growth and increases the photosynthetic and metabolic activities resulting in more transport and utilization of photosynthetic products which might have resulted in increased spike length. Similar results were also reported by Vijai Kumar and Singh (2005) in cv. Congo Song and Rajesh bhalla and Ajay Kumar (2007) in cv. White prosperity. Flower inducing ability of Benzyl adenine was reported by several workers under in vitro as well as in vivo conditions. Induction of flowering may be due to its ability to alter the assimilate distribution i.e. the theory of nutrient diversion (Sachs *et al.,* 1979).

Number of florets were maximum (10.05) in gladiolus cv. White prosperity (Table 3). All the plant growth regulators improved the number of florets with increased concentrations. Among the plant growth regulator treatments, GA_3 at 125 ppm increased the number of florets per spike (11.00) followed by GA_3 at 100 ppm (10.73), however minimum number of florets per spike was observed with BA at 25 ppm (8.96) (Table 3). Increase in number of florets per spike with treatments in gladiolus have been reported by Rajesh bhalla and Ajay Kumar (2007) in cv. White prosperity. Reduced number of florets with NAA might be due to reduced number of nodes which resulted in reduced plant height and spike length. Similar results were reported by Sharga (1979) and Bhattacharjee (1984) in gladiolus cv. Friendship.

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