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INFLUENCE OF GIBBERELLIC ACID AND PLANT GEOMETRY ON GROWTH, FLOWERING AND CORM PRODUCTION IN GLADIOLUS (*GLADIOLUS GRANDIFLORUS*) UNDER JAMMU AGROCLIMATE

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ABSTRACT

The present investigation was conducted to study the effect of gibberellic acid and plant geometry on growth, flowering and corm production in gladiolus cv. 'Novalux' under Jammu conditions. Four concentrations of GA_3 (0, 100, 200 and 300 ppm) and three levels of spacing (20x40cm, 30x40cm and 40x40 cm) were tested in Factorial RBD with three replications. The analyzed data indicated that maximum plant height, number of leaves, leaf width, spike length, rachis length, corm diameter, corm weight and early flowering was recorded at 300 ppm GA_3. Corms planted at a spacing of 40x40cm exhibited highest plant height, rachis length, number of florets per spike, floret diameter, number of corms per plant, corm diameter, corm and cormel weight. Among interactions, treatment of corms with 300ppm GA_3 and spacing at 40x40 cm was found more effective in the enhancement of vegetative and floral attributes.

KEYWORDS: Gibberellic acid, plant geometry, gladiolus, bulb production

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INTRODUCTION

Jammu region of J & K state is considered as city of temples. There is always a huge demand of flowers for religious offerings and for decorations during marriage ceremonies and festivals. Area under floriculture in Jammu region is about 200 hectares and maximum under marigold. Flower growers of this region are growing the marigold crop commercially due to its easy cultivation. Now-a-days, increased demand of cut flowers in the market due to its usage in flower arrangements and bouquets making and enhancement in purchasing power capacity of large section of society, encourages the Jammu farmers engaged in floriculture to grow cut flowers for profitable business. Among cut flowers, gladiolus is the most popular ornamental crop due to their elegant attractive spikes of different hues and long vase life. But very few farmers of this region are growing gladiolus commercially due to lack of production technology and availability of quality planting material. The quality flower and corm production of gladiolus can be improved by several factors. The application of plant growth regulators is one of the most important factors in improving the growth, yield and flower quality (Nuvale *et al*., 2010). Among plant growth regulators, use of exogenous gibberellin in breaking dormancy is not well understood but it has been postulated that gibberellins regulate mobilization of food reserves (Mares *et al*., 1981) and interact with inhibitors such as abscissic acid (Hemberg, 1965). Gibberellic acid (GA_3) has been used to increase the length or height of plants, increase the number of flowers and induce early flowering (Taiz and Zeiger, 2002) where as plant spacing is an another important factor, which plays a significant role on growth and yield of gladiolus at its optimum level by providing scope for efficient utilization of solar radiation and nutrients to the plants (Sanjib *et al.,* 2002). Keeping in view the above mentioned role of gibberellic acid and plant population on various morphological and floral attributes of gladiolus, present investigation was carried out to investigate the appropriate concentration and combination of GA_3 and plant spacing levels for better growth, flowering and corm production in gladiolus under Jammu conditions.

MATERIALS AND METHODS

The research was conducted at the Experimental Farm of Division of Vegetable Science and Floriculture, Faculty of Agriculture, SKUAST-Jammu, Chatha during 2008-2009. The experimental field at Chatha is located in the sub-tropical zone of Jammu region at 32°39' North latitude , 74°48' East longitude and 296 metres average mean sea level. The experimental site receives average annual rainfall of 1000-1200 mm and temperature rises upto 45°C or more during summer season and falls to 5°C during extreme winters. The soil of the experimental site was loamy in texture and almost neutral in reaction. Four concentrations of GA_3 (0, 100, 200 and 300ppm) at three levels of spacing (20x40 cm, 30x40 cm and 40x40 cm) were tested.. The experiment was laid out under factorial randomized block design with three replications. Uniform sized corms of 3.5 cm diameter were soaked in freshly prepared gibberellic acid solutions for 24 h while control corms were dipped in tap water for the same period and then planted at different spacings in the 1st week of October.. The observations on different parameters were recorded time to time and analysed statistically.

RESULTS AND DISCUSSION

VEGETATIVE PARAMETERS

Data presented in Table1 revealed that different treatments of GA_3 significantly influenced the vegetative characters of gladiolus. Plant height (120.90 cm), number of leaves (9.37) and leaf width (5.41cm) was recorded maximum at highest concentration of GA_3 i.e.300 ppm while minimum observations were recorded in control. This may be due to 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 (Taiz and Zeiger, 1998). A significant increase in the vegetative characters with increase in concentrations of GA_3 was also reported by Al-Khassawreh *et al*. (2006) in black iris and Bhalla and Kumar (2008) in gladiolus. The results indicated that corms planted at different spacings showed significant variation in plant height. However, non significant effect was observed in number of leaves per plant and leaf width. Maximum plant height (112.51 cm) was recorded at the widest spacing (40x40cm) followed by 20x40 cm spacing.These results are in close agreement with the findings of Sujata and Singh (1991), Yadav and Singh (1996) and Bhat *et al*. (2009) in gladiolus. The interaction between GA_3 and spacing significantly affected plant height. Amongst interactions, maximum plant height (125.00 cm) was recorded in the treatment having 300 ppm GA_3 with 40x40 cm spacing. This response was attributed to rapid cell division due to more availability of light to the plants at wider spacing. Gibberellins react with light to modify certain developmental effects (Salisbury and Ross, 1991). However, non significant difference was observed in number of leaves per plant and leaf width.

FLOWERING PARAMETERS

All the flowering parameters were significantly influenced by the treatmentsof gibberellic acid (Table 2). Early flowering (81.73 days), maximum spike length (96.03 cm), rachis length (68.55 cm) and floret diameter (9.55 cm) was recorded at 300ppm GA_3 where as the highest number of florets per spike were observed at 200ppm GA_3 followed by 300ppm GA_3 concentration. Gibberellic acid promotes vegetative growth and increases the photosynthetic and metabolic activities causing more transport and utilization of photosynthetic products (Halevy and Shilo, 1970). As a result, spike length and rachis length increases there by allowing florets to grow larger because the florets have more room to do so (Taiz and Zeiger, 1998). Similar results were given by Sanap *et al*.(2000), Al-Khassawreh *et al*.(2006), Sharma *et al*. (2006), Barman and Rajni (2004), Bhalla and Kumar (2008) and Mayoli *et al*. (2009). A significant increase in flowering parameters was recorded with the increasing levels of plant spacing. Minimum number of days taken to flowering (90.36 days), highest rachis length (61.62 cm), spike length (90.12 cm), number of florets per spike (16.95) and floret diameter was obtained at the widest spacing. This might be due to the fact that the closer spacings hamper intercultural operations and as such more competition arises among the plants for nutrients, air, and light. As a result, plant becomes weaker, thinner and consequently affects the flower parameters. These reports are in line with the findings of Kumar and Yadav (2006), Nagappa *et al.* (2006), Bhat *et al*.(2009) and Ahmed *et al*., 2010. There was significant effect of interaction on flowering parameters. Corms treated with highest concentration of GA_3 and planted at widest spacing produced flowering in minimum days (79.57) and exhibited longest rachis (78.00 cm) and spike length (101.37 cm) while more florets per spike (20.49) was observed at 200ppm GA_3 with 40x40 cm spacing and greatest floret diameter (10.11 cm) was recorded at 300ppm GA_3 with 30x40 cm spacing which were found statistically at par with 300ppm GA_3 and 40x40 cm spacing. Gibberellic acid enhances cell division, cell elongation and rapid development and its effect might have increased with more availability of solar radiations at wider spacing.

CORM AND CORMEL PRODUCTION

The analysed data presented in Table 3 indicated that corm and cormel production was significantly affected by gibberellic acid. Corms treated with 300 ppm GA_3 produced largest corm of diameter 7.02 cm with maximum weight of 41. 99g whereas highest number of corms per plant (1.65), cormels per plant (16.74) and heaviest cormel (11.04 g) was obtained at 200ppm GA_3 followed by 300 ppm GA_3 . In control, lowest yield contributing attributes like corm weight, number of cormels, weight of cormels and corm diameter were recorded. Similar results were given by Bhalla and Kumar (2008) and Laishram and Hatibarua (2009) in gladiolus. Amongst different levels of spacing, widest spacing (40x40 cm) significantly produced maximum number of corms per plant (1.45), corm diameter (6.85), weight of corm (40.63 g), more cormels per plant (12.65) and heaviest cormel (9.79g). This might be due to availability of more nutrients and light at wider spacings which ultimately increased the rate of net photosynthesis and translocation of assimilates to the storage organs. The positive response of wider spacing on corm and cormel production has also been observed by Kumar and Yadav (2006), Mane *et al*., 2006, Bhat *et al*. (2009) and Ahmed *et al*. (2010). The interaction 300 ppm GA_3 with 40x40 cm spacing significantly produced more number of corms per plant (1.98) while the least number was observed in the untreated corms and at 20x40 cm spacing. However, non significant effect of interaction was observed in corm weight, corm diameter, number of cormels per plant and cormel weight.

Table 1
Effect of gibberellic acid and spacing on certain growth parameters in gladiolus cv. 'Novalux'

Treatments	Plant Height (cm)				Number of leaves per plant				Leaf width (cm)			
	S_1 20x40	S_2 30x40	S_3 40x40	Mean	S_1 20x40	S_2 30x40	S_3 40x40	Mean	S_1 20x40	S_2 30x40	S_3 40x40	Mean
Control	86.44	90.37	108.53	95.11	8.33	8.00	8.66	8.33	4.56	5.00	5.11	4.89
100 ppm GA_3	110.47	96.29	110.15	105.64	9.00	8.50	9.07	8.86	5.52	4.58	4.68	4.93
200 ppm GA_3	113.34	115.14	106.37	111.62	9.27	9.50	8.66	9.14	4.61	5.00	4.73	4.78
300 ppm GA_3	117.11	120.58	125.00	120.9	9.00	9.33	9.78	9.37	5.46	5.23	5.53	5.41
Mean	106.84	105.6	112.51		8.9	8.83	9.04		5.03	4.95	5.01	
CD $_{0.05}$												
	GA_3		2.47			0.6				0.41		
	S :Spacing (cm)		2.14			NS				NS		
	GA3 x Spacing		4.28			NS				NS		

Table. 2
Effect of gibberellic acid and spacing on certain flowering parameters in gladiolus cv. 'Novalux'

Treatments	Days taken to first flowering				Rachis Length (cm)				Spike length (cm)				No. of florets per spike				Floret diameter (cm)			
	S_1 20x40	S_2 30x40	S_3 40x40	Mean	S_1 20x40	S_2 30x40	S_3 40x40	Mean	S_1 20x40	S_2 30x40	S_3 40x40	Mean	S_1 20x40	S_2 30x40	S_3 40x40	Mean	S_1 20x40	S_2 30x40	S_3 40x40	Mean
Control	107.67	102.00	98.59	102.80	43.66	47.16	51.43	47.42	73.70	77.18	81.25	77.38	11.56	12.51	12.41	12.41	4.97	5.07	5.13	5.06
100 ppm GA_3	95.41	99.28	94.81	96.50	55.37	56.39	57.85	56.54	85.32	86.34	88.53	86.73	14.62	13.42	15.46	14.50	6.07	6.33	8.43	6.94
200 ppm GA_3	87.50	82.52	88.47	86.16	63.33	67.36	62.21	65.30	94.23	98.27	93.34	95.28	15.35	17.29	20.49	17.71	7.87	8.13	9.97	8.66
300 ppm GA_3	84.47	81.15	79.57	81.73	62.34	65.31	78.00	68.55	92.37	94.35	101.37	96.03	14.60	14.45	19.44	16.16	8.03	10.10	10.50	9.55
Mean	93.76	91.24	90.36		55.42	58.31	61.62		85.41	88.04	90.12		14.03	14.42	16.95		6.73	7.41	8.51	
CD $_{0.05}$																				
	GA_3		2.82				4.07				2.54				1.33				0.48	
	S:Spacing(cm)		2.44				3.52				2.2				1.15				0.41	
	GA_3 x spacing		4.89				7.05				4.41				2.30				0.82	

Table. 3
Effect of gibberellic acid and spacing on corm and cormel production in gladiolus cv. 'Novalux'

Treatments	No. of Corms per plant				Corm weight (g)				Corm Diameter (cm)				No. of cormels per Plant				Cormel Weight (g)			
	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean
	20x40	30x40	40x40		20x40	30x40	40x40		20x40	30x40	40x40		20x40	30x40	40x40		20x40	30x40	40x40	
Control	1.04	1.01	1.3	1.12	3.97	5.03	5.73	4.91	25.49	30.58	35.65	30.57	4.33	4.58	6.3	5.07	5.1	5.02	7.05	5.72
100 ppm GA_3	1.40	1.00	1.44	1.28	4.93	6.00	6.3	5.74	27.54	30.28	37.35	31.72	8.07	10.03	11.2	9.76	7.24	7.15	8.02	7.47
200 ppm GA_3	1.6	1.6	1.07	1.65	5.53	6.2	7.29	6.34	31.37	36.29	43.39	37.01	16.13	16.03	18.06	16.74	10.03	10.03	13.06	11.04
300 ppm GA_3	1.41	1.55	1.98	1.42	5.97	7.03	8.07	7.02	37.31	42.52	46.13	41.99	11.08	13.02	15.03	13.04	8.05	9	11.02	9.36
Mean	1.36	1.29	1.45		5.1	6.07	6.85		30.43	34.92	40.63		9.9	10.91	12.65		7.6	7.8	9.79	
CD $_{0.05}$																				
GA_3		0.09				0.35				1.72				0.69				0.83		
S:Spacing(cm)		0.08				0.3				1.49				0.6				0.72		
GA_3 x spacing		0.16				NS				NS				NS				NS		

CONCLUSION

Based on these results, it can be concluded that 300 ppm GA_3 and 40x40 cm spacing proved to be best for the quality flower and corm production of gladiolus cv. 'Novalux' under Jammu conditions.

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