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Effect of GA_3 on Vegetative Growth and Sprouting in Gladiolus

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A B S T R A C T

Gladiolus (family Iridaceae) is one of the most important bulbous flower crops due to its long attractive spike with variety of colours, prolonged vase life and its ability to withstand long distance transportation. The role of growth regulators in growth & flowering of gladiolus has received considerable attention recently though very little work has been done on this aspect, hence the present study was under taken. The experiment was conducted in the experimental area of the Department of Horticulture consisting of four concentrations of GA_3 (25, 50, 75, & 100 ppm). The experiment was conducted in FRBD. Healthy and uniform size of corms of four different varieties of Gladiolus (V1-American Beauty, V2-Pacifica, and V3- Summer Pearl and V4-Single Jester) was planted in first week of June at spacing of 20x50cm. Un-treated control was also maintained. In all there were 20 treatments each with 10 plants replicated thrice in FRBD. The observations were recorded on various vegetative growths, cormel production and floral attributes, Spikes were harvested when basal florets showed colour. In this investigation GA_3 100 ppm was found most effective for enhancing vegetative growth, earliest sprouting (6.60 days), maximum plant height (132.83 cm), no. of leaves (10.86), initiation of spike (48.6 days), However maximum spike length (79.27 cm), rachis length (70.13cm), Treatment with GA_3 showed delayed 50% heading in (101.66 days) at 100 ppm. Different treatments with GA_3 failed to exert any significant influence on total number of spike. The results revealed that var. Summer Pearl recorded earliest sprouting (6.60 days), maximum plant height (132.83 cm), (16.43) While maximum spike length (79.27cm), earlier initiation of spike (48.60days) and rachis length (70.13 cm) were recorded in Pacifica. Maximum number of leaves (10.86).

Introduction

Floriculture is an age old farming activity in India having immense potential for generating gainful self-employment among small and marginal farmers. In the recent years it has emerged as a profitable agri-business in India and worldwide as improved standards of living and growing consciousness among the citizens across the globe to live in environment friendly atmosphere has led to an increase in the demand of floriculture products in the developed as well as in the developing countries worldwide. The production and trade of floriculture has increased consistently over the last 10 years. In India, Floriculture industry comprises

flower trade, production of nursery plants and potted plants, seed and bulb production, micro propagation and extraction of essential oils. Though the annual domestic demand for the flowers is growing at a rate of over 25% and international demand at around Rs 90,000 crore India's share in international market of flowers is negligible. However, India is having a better scope in the future as there is a shift in trend towards tropical flowers and this can be gainfully exploited by country like India with high amount of diversity in indigenous flora.

Jharkhand with its diverse agro-climatic conditions have great potentialities of flower cultivation which will help the small and marginal farmers generating remunerative self-employment and also for earning foreign exchange through export floricultural produce.

Growth regulators have been found to influence the growth of gladiolus.GA3 has many regulatory effects on plant development. It stimulates synthesis of hydrolytic enzymes for digestion of endosperms reserves. GA3 stimulate both cell division as well as cell enlargement. It can move freely along the stem in either acropetal or basipetal direction. The role of gibberellins is complicated both biologically, biochemically and even today is not fully understood (Arora *et al.*,; 1992). Moreover, when applied externally, gibberellins influence the organization of the internal chemistry of the plant cell and interaction among cells, but the degree of interaction still depends mostly upon the plant species, the stage of plant development and external environment.

Singh *et al.,* (2008) reported that gibberellic acid treatment cause to increase in longevity of gladiolus cut flowers; Mutuee *et al.,* (2001) concluded that gibberellins increase fresh weight of cut flowers; Weiss in 2000 reported that gibberellic acid could be a promoter for starting extension, coloration of flower and some genes of essential enzymes in anthocyanin pathway such as chalkon synthetase, chalkon isomerase, dihydroflavinol reductase. This plant growth regulator is produced in anthers, which are in developmental stage and then it is transferred into corolla where it enhances physiological and biological processes such as petal growth and pigment production.

The plateau region of Jharkhand offers an excellent climatic condition for cultivation of gladiolus, but little work has been conducted on the standardization of technology for gladiolus growing in this region. For successful production of any bulbous crop, growth regulators play an important role.

Materials and Methods

Experimental site

The site is located in the experimental area of the department of horticulture, under the faculty of Agriculture, Birsa Agricultural University, Kanke, Ranchi, Jharkhand during Kharif season of 2010.

Meteorological condition

The climate of Ranchi is sub humid tropical. The geographical situation of the place is between 23.17^0 latitude and 85^o19E longitude and at an altitude of 625m above the mean sea level. The average annual rainfall is 1300-1400mm and most of which is received between months of June to August. The climate is sub divided into distinct season i.e. summer, rainy and winter. Data on weather conditions were collected from meteorological observatory of the university throughout the experimental period. The distribution and occurrence of the different

aspect of weather has been given in Table 3.I and have been illustrated in Fig 3.1. The mean daily temperature of the area is about 19.50^{o} C, the region is characterized by moderate summer and cold winter with lowest January temperature (coldest month) dropping down to 3.5^{0} c and highest May temperature (hottest month) rising upto 39.2^{0} c. The mean humidity is about 64 percent in the area.

Experimental detail

Treatments and varieties

The present investigation was carried out with four different levels of gibberellic acid (GA3) applied on the corms of four different varieties of Gladiolus (V1-American Beauty, V2-Pacifica, and V3- Summer Pearl and V4-Single Jester). Varieties of gladiolus were procured from department of horticulture, B.A.U., Kanke, Ranchi. The treatment combinations used in this experiment have been given in Table.1.

Layout, plan and experimental design

The field experiment was laid out in Factorial Randomized Block Design (FRBD) with 20 treatments and three replications. There were three sub-plots, each having a size of 5mx 5m. All the treatments were accommodated in sub- plot randomly and each sub-plot consisted of 200 plants at a distance of 50cm x 20cm. A space of 50 cm was left between two sub plots.

Fertilizers

NPK was applied in two split doses, as basal application doses @ 10:20:20g/ Sqm and @5:10:10/5g/Sqm in top dressing

FYM applied as soil application @Uniform dose of 5 Kg/sqm.

Preparation of experimental plot

The plot was cleaned by removing weeds, stubble and was thoroughly ploughed till the soil was brought to fine tilth. The plot was leveled and laid out according to plan. The well decomposed farm yard manure at the rate of 5kg/sqm was added to each plot and was incorporated in soil. Soil sampling was done randomly from different plots as per the soil sampling techniques. The composite soil sample was prepared by mixing these samples and the composite soil sample was subjected to analysis. NPK were applied inform of urea, SSP and MOP respectively @ dose 10:20:20g/sqm. FYM was applied at the rate 5kg/sqm. For this 125 kg was applied in each plot. The corms of uniform size from all varieties were selected; covering was removed gently without damaging the corms.

The corms were soaked in GA3 for at least 24 hrs and dried properly under the shade and were sown in each plot according to layout and plan. Plants were irrigated as needed or whenever necessary throughout the cropping season by flooding method. Weeding and hoeing was done regularly starting from 15 days onwards after corms planting and whenever necessary throughout growing period. Regular Spraying of the plants with 0.2 percent Bavistin at an interval of 15-20 days was done to avoid the incidence of diseases. Spikes were harvested when the basal bud was just showing color. Spikes were cut just about where the stalk emerged from the sheathing leaf cluster. Corms were dug out after 45 days from flowering when the leaves started yellowing. They were dug out carefully so that no corms and cormels were lost in the process. The aerial parts, corms and cormel were separated and counted. The corms were dipped in 0.2 percent Bavistin solution for half an hr. and then air dried in shade and kept in Kraft paper bags in open crates for storage.

Recording of observation

Following observation on growth, yield and quality of flower, corms and cormels were recorded at proper time during experimentation.

Days to sprouting:
Days to initiation of spike:
Spike length:
Rachis length:
Plant height:
Number of leaves per plant:
Days to 50% heading:
Total number of spikes:

Statistical analysis

Date obtained from several attributes was analyzed statistically by the procedure described by Gomez and Gomez, 1984.

Results and Discussion

The result with logical interpretation as influenced by different treatment has been presented in chapter with the help of appropriate table and suitable figures.

An experiment to study the effect of GA3 on growth and spike development of gladiolus was designed and laid out in the field during the period June 2010 to December 2010 in the Department of Horticulture, Birsa Agricultural University, Ranchi. The observational data on different growth parameters, flowering, cormel production and its components were recorded during the course of investigation. The data obtained were analyzed for statistical test of significance.

The result with logical interpretation as influenced by different treatment has been presented in chapter with the help of appropriate table and suitable figures.

Days to sprouting

The observations on days to sprouting have been presented in table.1 and Fig..1. Interaction of VXT has been graphically depicted in Fig. 4.2.1. From the perusal of data it was observed that different levels of GA_3 influence the sprouting. Significantly earliest sprouting was recorded with treatment T_4 (9.00days) while late sprouting was observed in T_1 (9.80 days) and it was at par with T_3 (9.02days), T_1 (9.09days) and T_2 (9.20days), late sprouting was observed in T_0 (9.8days)

Similarly the different levels of GA_3 were found to have non- significant influence on sprouting among different varieties. However, earliest sprouting was observed in V2 i.e. Pacifica (9.20days) which was at par with V3 and V4.

The interaction result of VxT was found to significantly influence the sprouting. The minimum number of days taken for sprouting was recorded with treatment combination V3T3 (6.60 days).

Days to initiation of spike

The observations on days to initiation of spike have been presented in Table.2, and graphically represented in Fig.4.2.2. Interaction VXT has also been graphically represented in fig.2.

From the perusal of data it was revealed that different levels of GA significantly influence the character. Earliest spike initiation was recorded with T4 (61.44 days) followed by T3 (64.15 days) and T2(65.02days) The doses of GA3 took lesser number of days for initiation of spike as compared to the control.

The varieties did not have any significant influence on initiation of spike. However,

earliest initiation of spike was recorded in V2 (64.74days) followed by V1 (69.40days) which was statistically at par with V3 (69.15days).

The interaction VXT had significant influence on days taken for spike initiation. Earliest spike initiation was recorded with V2T4 (48.60 days) followed by V1T3 (54.00 days), V2T1 (60.80days) and V4T4 (61.17days) while maximum 86.8 days was taken by V1T0 (85.53days), V4T0, (81.23days) and V3T0 (76.96days),

Spike length

The data pertaining to spike length have been presented in Table.3, and depicted in Fig.3 and Interaction VXT has been graphically represented in fig. 4.2.3.

The data in Table.3 revealed that GA3 significantly influenced the spike length with maximum T4 (67.35cm), closely followed by T1 (66.31cm) while it was only 55.18 cm in T0. The different levels of GA3 showed significant influence on spike length of different varieties. Maximum spike length was recorded in V4 (63.31cm), followed by V2 (63.69cm) and V3 (62.93cm) where V2 and V3 were statistically at par with each other.

On studying the interaction, as presented in Table.3. It was revealed that among different treatment combination, V2T2 recorded maximum spike length of 79.27cm), followed V4T1 (74.90cm), V4T4 (69.53cm), V3T0 (69.50cm) while minimum spike length was observed in V1T0 (47.23cm).

Rachis length

The data pertaining to rachis length have been presented in Table.4., Fig.4 and interaction VXT has been graphically represented in fig.4. The data in this table revealed that GA3 treatment significantly influenced the rachis length. Rachis length was maximum in T4 (61.65cm) and it was significantly superior to all other treatments. Similarly, among the four different varieties, V2 recorded significantly maximum rachis length (54.70cm) followed by V4 (52.82cm).

VXT interaction showed significant influence on rachis length. However, the maximum length of rachis was recorded with the treatment combination V2T2 (70.13cm) followed by V4T4 (67.90cm), V1T2 (66.56) and V3T4 (63.96cm), while the treatment combination V1T0 recorded the least rachis length (25.63cm).

Plant height

The plant height attained in different treatments at different stages of plant growth has been recorded. The data regarding ultimate plant height has been presented in Table.5 and Fig.5. Interaction VXT has been graphically represented in fig.5. From the perusal of data, it was evident that the ultimate plant height was significantly higher at higher levels of GA3, maximum plant height was recorded in T4 (130.12 cm) followed by T3 (103.78 cm).

The varieties had no significant influence on plant height, however maximum plant height was recorded in V4 (107.57 cm) followed by T3 (106.78cm).V1 (103.04cm) and V3 (103.57 cm) were at par with each other.

From the data for plant height, it could be analyzed that the interaction of VXT, significantly influence the ultimate plant height. The treatment combination, V3T3 recorded maximum plant height (132.83cm), followed by V2T4 (129.98cm), V4T4 (129.82cm) and V1T4 (127.87cm) which were statistically at par with each V3T3.

Number of leaves per plant

The data pertaining to the number of leaves at different stages of plant growth have been presented in Table.6, Fig.6 and graphically depicted in Fig.6.

From the perusal of Table.5, it was revealed that, different levels of GA3, significantly influence the number of leaves. Maximum number of leaves were recorded in T4 (9.74) followed by T3 and T2 (9.2).

However, varieties had no significant influence on number of leaves. Although, maximum number of leaves were recorded in V1 (9.37).

In similar way, the interaction of V X T failed to produce significant effect on number of leaves per plant.

The ultimate number of leaves varied from 8.43 under treatment combination of V2T0 to 10.86 under treatment combination of V1T4.

Days to 50% heading

The data pertaining to days to 50% heading have been presented (Table.7, Fig.7) and Interaction VXT has also been graphically represented in fig.7.

The effect of GA3 was found to be significant on days to 50% heading as it is evident from Table.7.

The days to 50% heading was significantly earlier in T4 (60.15 days) followed by T2 (66.25) which was statistically at par with T3 (66.71)

The different varieties were found to significantly influence the days to 50% heading. It was earliest in V2 (70.95 days) followed by V1 (72.50) and V3 (73.13). V1 (72.50) and V3 (73.13) were statistically at par with V2 (70.95)

As evident from the data, the interaction of VXT was found to have significant influence on days to 50% heading. The treatment combination V1T4 took least number of days (54.26 days) for 50% heading and it was at par with V1T1, V2T1, V3T2, V4T2, V2T3, V2T4, V3T4, and V4T4.Maximum number of days for 50% heading was taken by V1T0.

Total number of spikes

The observation on total number of spikes per plant has been presented in Table.8, Fig.8 and interaction VXT has also been graphically represented in fig.8.

From the perusal of data, it can be said that different levels of GA3 affect the characters significantly. The total number of spikes was significantly higher with T2 (2.63) but the varieties failed to produced any significant influence on total number of spikes though it was maximum in V3 (2.29) and V4 (2.29)

Interaction of VXT was found to have significant effect on total number of spikes. The treatment combination V4T2 (3.26) showed maximum number of spikes followed by V1T3 (3.06), V2T3 (3.00) and V4T4 (2.93)

The data pertaining to vase life of cut flowers have been presented in Table 4.14, Fig. 4.1.14 and interaction VXT has also been graphically represented.

Perusal of data revealed that vase life of cut flowers was significantly influenced by GA3. With application of higher concentration of GA3 that is (100 ppm) cut flowers survived maximum number of days in the vase (11.68days).

The varieties did not influence the vase-life significantly, however maximum vase-life was observed with the V3 (10.76days)

The interaction VXT showed that GA3 in combination with different varieties significantly enhanced the vase-life. The treatment combination V4T4 recorded the maximum vase-life of 14.6 days as compared to only 7.76 days in controls i:e V1T0.

The present investigation was carried out to study the effect of Gibberellic Acid on growth and spike development of gladiolus cv. In the preceding chapter, the observation taken on different parameters and analysis of result were given in detail. In this chapter attempts have been made to critically discuss the results obtained with reference to earlier findings.

The growth parameters of plant primarily is an expression of its genotypic and phenotypic character but at times, so it may be modified by prevailing controlled as well as uncontrolled factors to a certain degree.

As successful cultivation of gladiolus crop is influenced by the prevailing weather condition during the growing season, it is essential to study the variation caused by various treatments along with the prevailing weather condition during the cropping period. Among the major meteorological phenomenon affecting crop production, temperature varied from 21^{o} c to 35.5^{0} c. The monthly average rainfall received during the growth period i.e. from June 2010 to December 2010 was 48.96 mm.

In the present investigation soaking of gladiolus corms in different levels of GA_3 (0, 25, 50, 75 and 100 ppm) influenced the days to sprouting of corms significantly (Table.1). In gladiolus, sprouting depends upon their physiological conditions and completion of dormancy in the corms. Under present study, significantly earliest sprouting was reported with treatment T4 (9 Days), while late sprouting was observed in T0 (9.8 Days)

The interaction of variety X Treatment recorded significantly minimum number of days for sprouting with treatment combination V3T3 (6.6 Days), (Table.1, Fig.1).

With increase in level of GA_3 there was significant decrease in days for sprouting (V1T1 8.90, V2T2 7.30, V3T3 6.60 and V4T4 6.70 days) in all the four varieties of gladiolus. The decrease in days to sprouting may be due to increased level of exogenous gibberellins activity in corms. Sprouting is the function of increased nucleotide, nucleic acid cell division and cell multiplication (Salisbury and Ross, 1986). Positive influence of GA_3 on days to sprouting of gladiolus has also been observed by Kumar (2009), who reported earlier sprouting by dipping corms in 125 ppm GA_3; Dutta. *et al.*, (2008) observed earlier sprouting by soaking corms in 100 ppm GA_3; Auge (1982), reported earlier sprouting which was treated with GA_3, Kumar and Singh (2008), reported earlier sprouting by soaking corms in GA_3 (100ppm) for 24 hours.

The plant height as influenced by different level of GA_3 was found to be significant. (Table.2, Fig.2). The increase in plant height may be due to the fact that GA_3 induces active cell division in the apical meristem and is also helpful in elongation of individual cells. By soaking the corms in gibberellic acid (GA_3 400 ppm), Kumar and Singh (2008) obtained increased, plant height (76.33). Berman and Rajni (2004) observed that Soaking of corms in GA_3 for 24 hrs was more influencing than 12 hours soaking for plant height. Yousuf *et al.*, (2006) observed that pre-soaking of gladioli corms for 24 hrs at concentration (0-100ppm) in GA_3 increased the plant height. Castro *et al.*, (1979), vernalised gladiolus corms at 4 and 8^{o}c for two weeks then soaked

for 24 hours in 1000 ppm GA_3, reported increased plant height. Mohanty *et al.,* (1994) observed that GA_3 increased plant height at 250ppm. Chattar *et al.,* (2006), treaded corms of gladiolus (Red Beauty, Jester, Summer face.) with four different levels of GA_3 (0, 100, 200, and 300 ppm). They observed maximum plant height 100.4 and 102.39, at 200 and 300ppm respectively.

The influence of GA_3 on number of leaves was found to be non-significant (Table 4.3 and Fig 4.3. However, maximum numbers of leaves (10.86) were observed in the cultivar. American Beauty treated with 100 ppm GA_3. It may be due to the fact that GA_3 stimulated the assimilation of carbohydrates and protein, which in turn enhances the cell division and formation of more tissues resulting in more vegetative growth of the plant.

The effect of GA_3 on days taken to initiation of spike was found to be significant (Table.4 and Fig.4). Earliest initiation of spike was observed with higher doses of GA_3. The earlier spike development may be due to increased level of exogenous gibberellins activity in corms. Weiss (2000) also reported that GA_3 could be a promoter for shoot elongation and initiation of spike.

Prakash and Jha (1998), observed that GA_3 treatment at 150 ppm improved all the floral traits especially earlier Initiation of spike. Umrao *et al.,* (2007) obtained significant increase in vegetative and floral attributes in gladiolus cultivar Nova Lux by preplanting soaking of corms in GA_3 (100 and 150 ppm). Ramachandrudu and Thangam in the year 2007 reported that GA_3 (100ppm) advanced the days to spike emergence. Higher levels of GA_3 decreased the days taken for initiation of spike. Our findings are in partial agreement with Weiss (2000) and similar to Prakas and Jha (1998) who reported earlier initiation of spike by treating the corms with GA3.

The influence of GA_3 on days to 50% heading was found to be significant (Table.5 and Fig.5) earlier. Days to 50% heading was reported earlier at higher doses of GA_3 (100 ppm). The earlier 50% heading may be due to increased level of exogenous gibberellins activity because gibberellins enhance cell elongation, cell enlargement. (Salisbury and Ross, 1986); Rajiv *et al.,* (2002), reported that days to 50% heading (92 Days) and first florets showing colour (112 Days) were significantly earlier by dipping (24 hrs in GA3) + spraying at 40+65 Days after planting our finding is in partial agreement with Rajive *et al.,* (2002) Who observed earliest 50% heading at higher concentration of GA_3 (400ppm).

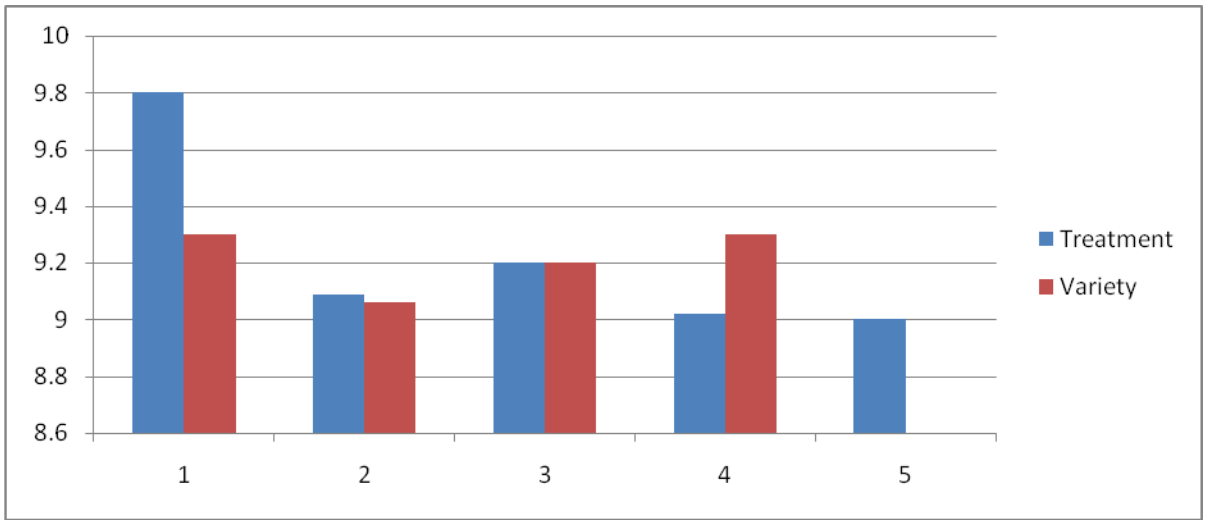
The influence of GA_3 on spike length was found to be significant (Table.6 and Fig..6) maximum spike length 79.27cm was recorded in corms treated with 50ppm GA_3. This effect might be due to the fact that GA_3 promotes vegetative growth and increases the photosynthetic and metabolic activities causing more transport and utilization of photosynthetic product (Halevy and Shillo 1970).

Overall treatment combination production of longest spike was at 50 ppm GA_3 in Pacifica similar results were obtained by Nilimesh and Ray Choudhary (1988), observed increased spike length with GA3 Rajiv *et al.,* (2002) also observed highest spike length (65.0 cm) at GA_3 (400ppm) in Jester. Ravidas *et al.,* (1992) observed largest spike with GA_3 treatment (50-100ppm) in gladiolus; Prakash and Jha (1998), observed that GA_3 treatment at 150ppm improved all the floral traits including largest spikes with 150 ppm GA_3. Our finding is in full agreement with Ravidas *et al.,* (1992).

Table.1 Days to sprouting of gladiolus varieties as affected by levels of GA_3

	V1	V2	V3	V4	Mean
T0	11.00	9.40	9.50	9.20	9.80
T1	6.73	10.30	9.70	9.66	9.09
T2	8.90	7.30	11.00	9.50	9.20
T3	9.20	8.83	6.60	11.33	9.02
T4	10.60	9.40	9.20	6.70	9.00
Mean	9.3	9.06	9.20	9.30	
	Variety	**Treatment**	**VXT**		
SEm	0.17	0.19	0.39		
CD (5%)	N.S	0.55	1.11		
CV (5%)	7.20				

WHERE T0 = Control, T1 = 25ppm, T2 = 50 ppm, T3 = 75 ppm, T4 = 100ppm



Graph showing result of Variety and Treatment

Fig.1 Days to sprouting of gladiolus varieties as effected by levels of GA_3

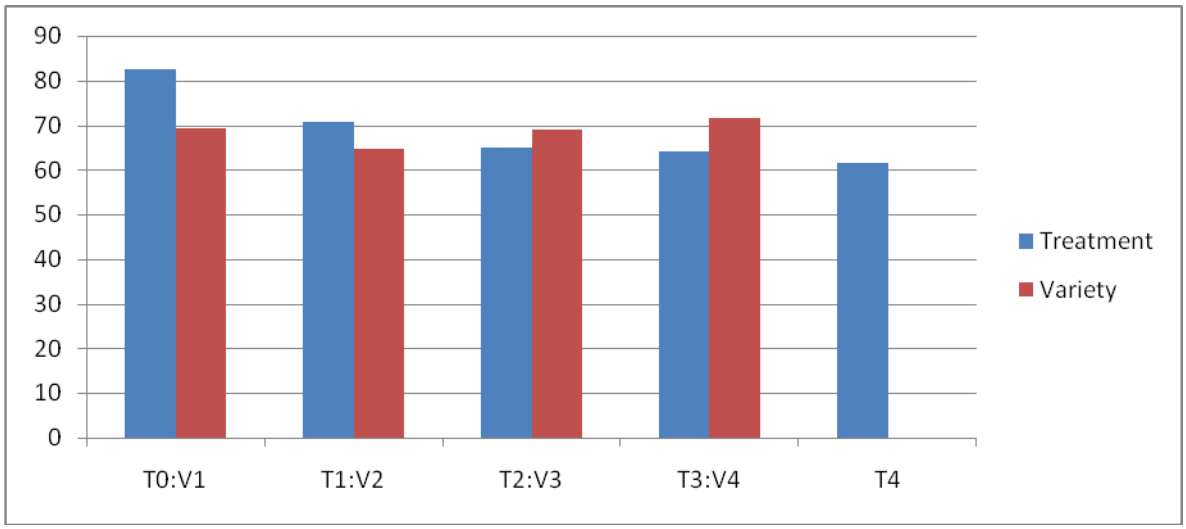
V1 = American Beauty, V2 = Pacifica, V3 = Summer Pearl, V4 = Single Jester

Table.2 Days taken to initiation of spike of gladiolus varieties affected by GA

	V1	**V2**	**V3**	**V4**	**Mean**
T0	86.8	85.53	76.96	81.23	82.63
T1	66.90	60.80	69.30	85.30	70.60
T2	69.6	64.16	63.63	62.70	65.02
T3	54.00	64.50	69.60	68.50	64.15
T4	69.70	48.60	66.23	61.17	61.44
Mean	69.40	64.74	69.15	71.70	
	VARIETIES	**TREATMENT**	**VxT**		
SEm	2.12	2.37	4.75		
CD5%	NS	6.70	13.50		
CV5%	11.90				

WHERE T0 = Control, T1 = 25ppm, T2 = 50 ppm, T3 = 75 ppm, T4 = 100ppm

V1 = American Beauty, V2 = Pacifica, V3 = Summer Pearl, V4 = Single Jester



Graph showing result of Variety and Treatment

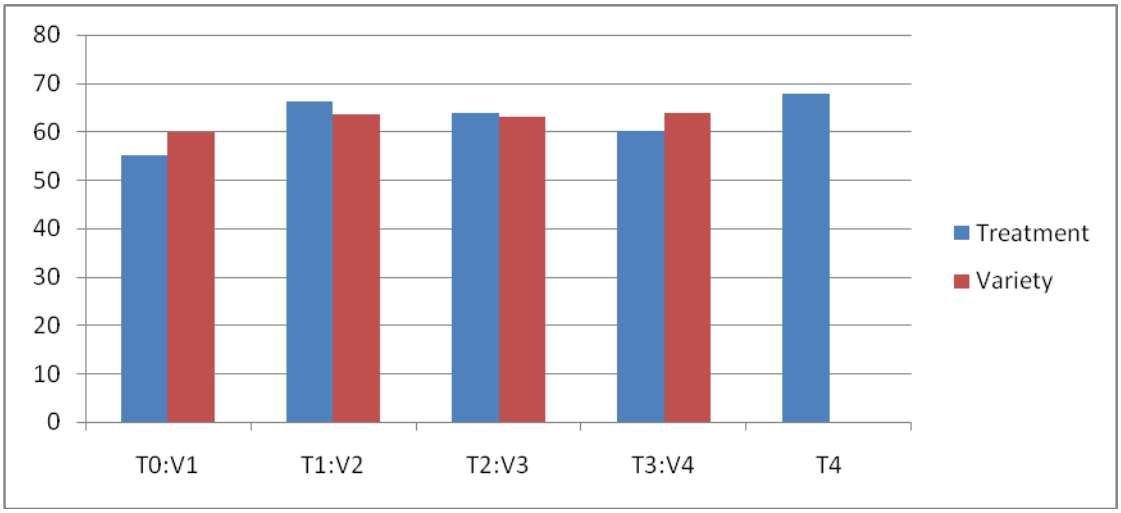
Fig.2 Days taken to initiation of spike of gladiolus varieties affected by GA_3.

Table.3 Spike length(cm) of gladiolus varieties as affected by levels of GA_3

	V1	**V2**	**V3**	**V4**	**Mean**
T0	47.23	47.39	69.50	56.61	55.18
T1	55.66	66.01	68.82	74.90	66.31
T2	69.27	79.27	52.40	54.93	63.83
T3	60.33	57.20	58.70	63.90	60.05
T4	66.40	68.13	65.33	69.53	67.75
Mean	59.78	63.69	62.93	63.78	
	VARIETIES	**TREATMENT**	**VxT**		
SEm	0.43	0.48	0.97		
CD5%	1.98	2.21	4.43		

WHERE T0 = Control, T1 = 25ppm, T2 = 50 ppm, T3 = 75 ppm, T4 = 100ppm

V1 = American Beauty, V2 = Pacifica, V3 = Summer Pearl, V4 = Single Jester



Graph showing result of Variety and Treatment

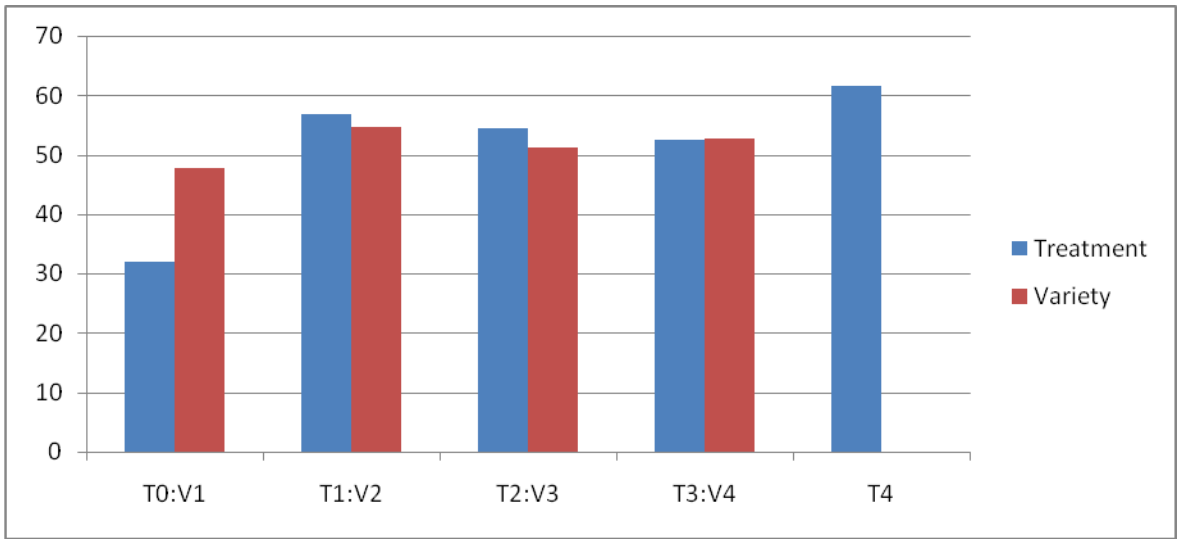
Fig.3 Spike length of gladiolus varieties as affected by levels of GA_3

Table.4 Rachis length(cm) of gladiolus varieties as affected by levels of GA_3

	V1	V2	V3	V4	Mean
T0	25.63	28.96	34.83	38.43	31.96
T1	43.40	59.86	59.30	65.10	56.91
T2	66.56	70.13	41.73	39.63	54.51
T3	48.46	52.66	56.00	53.03	52.54
T4	55.03	59.70	63.96	67.90	61.65
Mean	47.82	54.70	51.16	52.82	
	VARIETIES	**TREATMENT**	**VxT**		
SEm	1.08	1.20	2.41		
CD5%	3..09	3.45	6.91		
CV5%	8.10				

WHERE T0 = Control, T1 = 25ppm, T2 = 50 ppm, T3 = 75 ppm, T4 = 100ppm

V1 = American Beauty, V2 = Pacifica, V3 = Summer Pearl, V4 = Single Jester



Graph showing result of Variety and Treatment

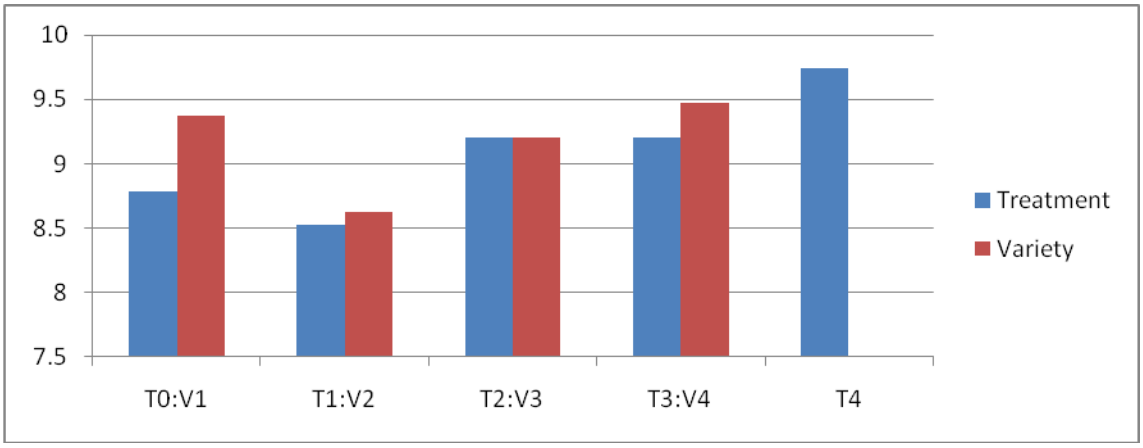
Fig.4 Rachis length (cm) of gladiolus varieties as affected by levels of GA_3

Table.5 Number of leaves per plant of gladiolus varieties as affected by levels GA_3.

	V1	V2	V3	V4	Mean
T0	8.96	8.43	8.73	9.00	8.78
T1	8.56	8.40	8.7	8.46	8.53
T2	9.23	8.40	9.20	9.40	9.2
T3	9.23	8.86	10.13	8.46	9.2
T4	10.86	9.06	9..13	9.90	9.74
mean	9.37	8.63	9.20	9.47	
	VARIETIES	**TREATMENT**	**VxT**		
SEm	0.223	0.249	0.49		
CD (5%)	N.S	0.17	N.S		
CV(5%)					

WHERE T0 = Control, T1 = 25ppm, T2 = 50 ppm, T3 = 75 ppm, T4 = 100ppm

V1 = American Beauty, V2 = Pacifica, V3 = Summer Pearl, V4 = Single Jester



Graph showing result of Variety and Treatment

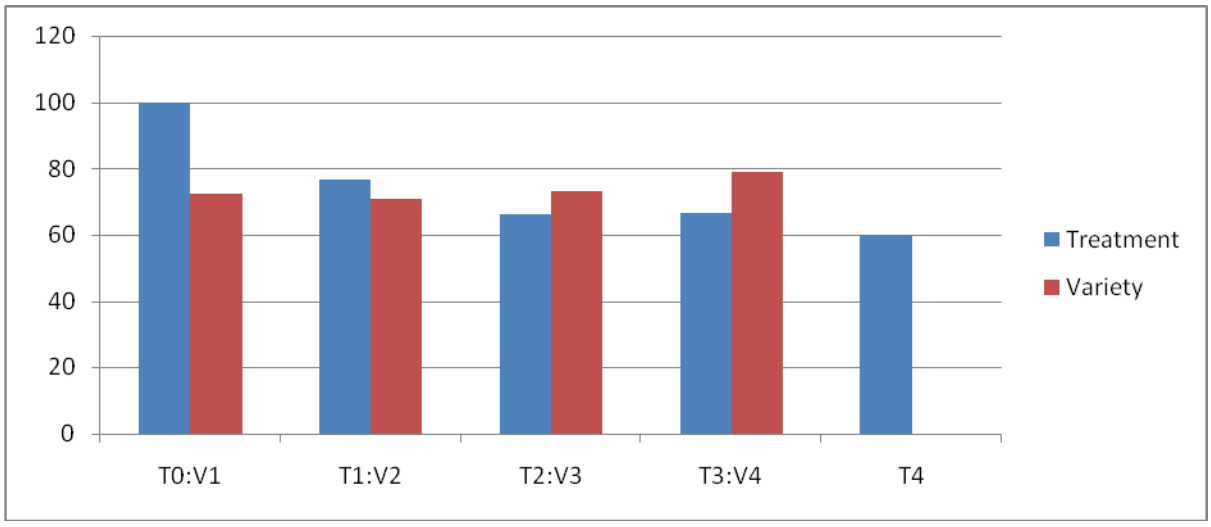
Fig.5 Number of leaves per plant of gladiolus varieties as affected by levels GA_3

Table.6 Days to 50% heading of gladiolus varieties as affected by levels of GA_3.

	V1	**V2**	**V3**	**V4**	**Mean**
T0	101.66	100.46	98.86	98.83	99.78
T1	63.06	63.53	76.60	103.6	76.71
T2	77.13	66.86	59.80	61.23	66.25
T3	66.40	63.46	68.13	68.86	66.71
T4	54.26	60.43	62.26	63.66	60.15
Mean	72.50	70.95	73.13	79.00	
	VARIETIES	**TREATMENT**	**VxT**		
SEm	1.65	1.85	3.70		
CD5%	4.74	5.30	10.60		
CV 5%	8.70				

WHERE T0 = Control, T1 = 25ppm, T2 = 50 ppm, T3 = 75 ppm, T4 = 100ppm

V1 = American Beauty, V2 = Pacifica, V3 = Summer Pearl, V4 = Single Jester



Graph showing result of Variety and Treatment

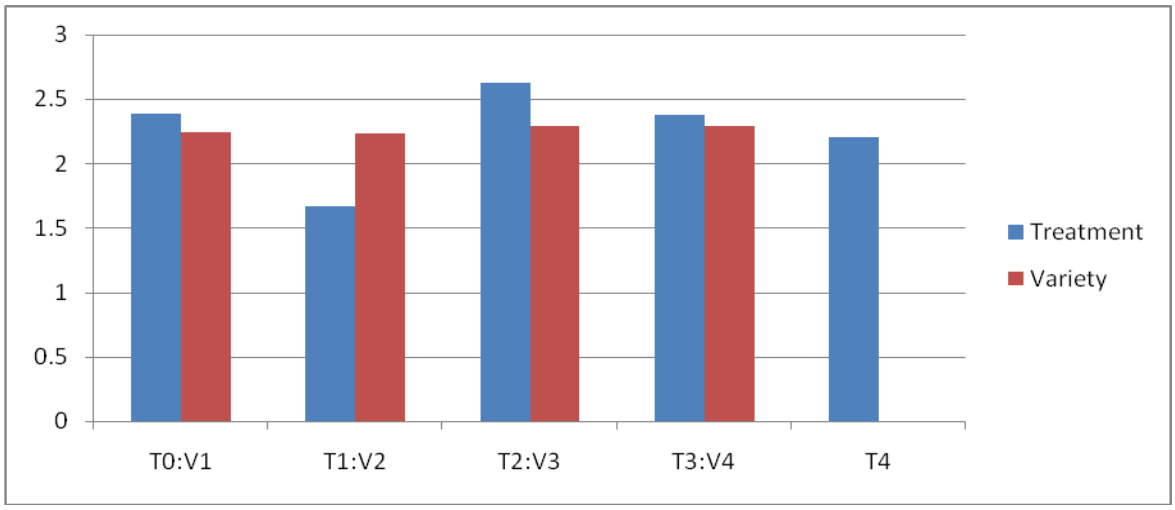
Fig.6 Days to 50% heading of gladiolus varieties as affected by levels of GA_3.

Table.7 Total number of spike of gladiolus varieties as affected by levels of GA_3

	V1	V2	V3	V4	Mean
T0	2.37	2.39	2.26	2.56	2.39
T1	2.33	1.50	1.53	1.46	1.67
T2	1.60	2.40	2.67	3.26	2.63
T3	3.06	3.00	2.27	1.20	2.38
T4	1.8	1.86	2.13	2.93	2.20
Mean	2.24	2.23	2.29	2.29	
	VARIETIES	**TREATMENT**	**VxT**		
SEm	0.13	0.15	0.30		
CD5%	N.S.	0.44	0.88		
CV5%	5.95				

WHERE T0 = Control, T1 = 25ppm, T2 = 50 ppm, T3 = 75 ppm, T4 = 100ppm

V1 = American Beauty, V2 = Pacifica, V3 = Summer Pearl, V4 = Single Jester



Graph showing result of Variety and Treatment

Fig.7 Total number of spike of gladiolus varieties as affected by levels of GA_3

The effect of GA_3 on number of spike was found to be non-significant (Table 4.7 and Fig.4.7). However, maximum numbers of spikes were observed in the Variety Single Jester treated with 50ppm GA_3.It may be due to the fact that GA_3 stimulated the assimilation of carbohydrate and protein, which in turn enhanced the cell division and formation of more tissue resulting in increased number of spikes per plant.

The influence of GA_3 on rachis length was found to be significant (Table 4.8 and Fig. 4.8). Increase in rachis length may be due to increased level of exogenous gibberellins activity which promotes cell elongation as

well as cell division. Weiss (2000) reported that GA_3 could be a promoter for shoot elongation. Rajiv *et al.,* (2002).

They observed increase in rachis length (41.66) was maximum in dipping and spraying at 40+60+90 days after planting gladiolus cv. Jester. Ravidas *et al.,* (1992), observed largest rachis length with GA_3 treatment (50-100ppm); Karaguzel (1999) observed increased length of flower stem by soaking of corms at 100ppm GA_3 for one hour; Chattar *et al.,* (2006) conducted field trials with gladiolus cultivars, (Red Beauty, Jester, Summer Face) as influenced by four levels of GA_3 (0,100,200, and 300 ppm). They observed maximum rachis length (62.85 and 60.47), at 200 and 300 ppm respectively. Our finding is in full agreement with Ravidas *et al.,* (1992).

The study was undertaken to observe the effect of gibberellic acid at four different concentrations on four different varieties of gladiolus regarding, yield and longevity of flowers and its cormel production. The results obtained on different character are summaries below.

A field experiment entitle "Effect of gibberellic acid on the growth and spike development of gladiolus" was conducted during June 2010 to December 2010 at experimental site of floricultural section in the department of horticulture, Birsa Agricultural University, Kanke, Ranchi in order to find out the optimum levels of GA_3 on gladiolus plant to fulfill its emerging production prospects under plateau region of Jharkhand. The study was also undertaken to observe the effect of gibberellic acid at four different concentrations on four different varieties of gladiolus regarding, yield and longevity of flowers and its cormel production. The results obtained on different character are summaries below.

Days to sprouting was significantly influenced by GA_3. Significantly earliest sprouting was recorded with treatment T4 (9.0Days). Earliest sprouting was observed in variety V2 i.e. Pacifica (9.06Days). The treatment combination with V3T3 (6.6Days) recorded minimum number days for sprouting.

Earliest spike initiation was recorded with T4 (61.44Days). Varieties did not have significant influence on days of initiation of spike. The interaction of variety and treatment was recorded significant influence, earliest spike initiation was recorded in V1T3 (54.00Days).

Higher doses of GA_3 T4 recorded maximum spike length of 67.35cm and 66.31cm, the treatment combination V2T2 recorded maximum spike length (79.27cm.), maximum spike length was observed in V4 (63.31cm.)

The rachis length was recorded maximum in T4 (61.65cm), maximum rachis length 54.70cm. Was recorded in variety V2 (54.70). Treatment combination V2T2 was found to be maximize the rachis length upto 70.13cm
Among different level of GA_3, higher dose of GA_3 resulted in maximum plant height (130.12cm).

No significant influence was observed among varieties, however maximum plant height was reported in V4 (107.57 cm). The treatment combination (V3T3) recorded maximum plant height of 132.83cm.

GA_3 levels have significant influence on the number of leaves. Maximum number of leaves were recorded in T4 (9.74).GA_3 failed to produce any significant influence on varieties as well as in interaction of variety and treatment.

The days to 50% heading was earlier in T4 (61.15 days).

Minimum duration of 50% heading was recorded in V2 (70.95 days). Earliest heading was recorded under interaction V1T4 (54.26) days.

The total number of spikes was significantly influenced by GA_3. Maximum numbers of spikes were reported with T2 (2.63), while no significant influence was observed in varieties. The interaction result V4T2 (3.26), recorded maximum number of spikes

On the basis of above finding it can be safely inferred that GA_3 at all levels recorded better vegetative growth, superior yield attributing features and vegetative traits plant height and spike length thus net returns increased in different cultivar of gladiolus.

Though all the four varieties responded positively to GA_3 treatment at all levels but the variety American Beauty along with concentration treatment with 100 ppm GA_3 gave the best result i.e. rachis length and higher spike length and hence can be recommended for commercial cultivation.

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