



## Effect of growth substances on growth, flowering and corm production in gladiolus (*Gladiolus grandiflorus*) cv White Prosperity under Bay Island conditions

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### ABSTRACT

Field experiment was conducted for two consecutive seasons during November-April of the years 2011-12 and 2012-13 in the Division of Horticulture and Forestry, Central Island Agricultural Research Institute, Port Blair to study the effect of plant growth regulators on gladiolus (*Gladiolus grandiflorus* Hort.) cv. White Prosperity. The results revealed that various growth, flowering and corm characters were significantly affected with the application of different growth regulators at different concentrations. Earliness in corm sprouting was observed by GA<sub>3</sub> at 500 ppm (10.6 days). Maximum number of leaves/plant and plant height was obtained by GA<sub>3</sub> at 750 ppm (8.2 and 111.0 cm respectively). More number of shoots per corm was observed by BA at 100 ppm (3.7). In respect of flower characters early spike emergence and maximum duration of the spike was recorded by GA<sub>3</sub> at 500 ppm (49.0 days and 17.5 days respectively). Maximum spike length, rachis length and number of florets per spike (79.3 cm, 56.5 cm and 14.7 respectively) were recorded by GA<sub>3</sub> at 750 ppm. In respect of corm characters maximum number of corms and cormels per plant was observed in BA 100 ppm (3.4 and 19.3 respectively). Maximum weight of single corm, weight of corms/plant, size of single corm and volume of single corm (77.5 g, 189.1 g, 7.6 cm and 86.3cc respectively) were recorded in GA<sub>3</sub> at 750 ppm. Maximum weight of cormels per plant was recorded in BA at 100 ppm (7.1g). Maximum value of propagation coefficient was recorded in GA<sub>3</sub> at 750 ppm (386.4%).

**Key words:** BA, GA<sub>3</sub>, Gladiolus, Growth regulators, NAA, White Prosperity

Gladiolus (*Gladiolus grandiflorus* Hort.) is one of the most important bulbous ornamental flower crop belonging to the family Iridaceae, and its grown in many parts of the world either as cut flower or for garden display. It is popularly known as Queen of the bulbous flowers due to its attractive shades, varying sizes of flowers, brilliant of colour tones and long lasting flower life. The magnificent inflorescence is also used for making bouquets and floral decorations. It has a great share in cut flower industry and fetches good premium for the money invested. It is cultivated all over the country due to ever increasing demand of this elegant cut flower. Use of growth regulators or phytohormones is one of the improved technique to control the growth and development in plants. Synthetic growth regulating chemicals have been reported to be very effective in manipulating growth, flowering and corm production in gladiolus (Mahesh and Misra 1993, Baskaran and Misra 2007, Suresh Kumar *et al.* 2008) They have been reported in enabling removal or circumvention of many of the barriers imposed by heredity and environment. Flower

cultivation in the Andaman and Nicobar Islands is gaining importance due to its ever increasing demand both for inland and tourism requirements. Gladiolus is one of the major cut flower crops and its cultivation can potentially increase the Island farmers economic prosperity as the demand is high in the Islands. The performance of any crop or variety largely depends on genotypic and environmental interaction. As a result, crop or cultivars, which perform well in one region, may not perform same in other region of varying climatic conditions. Hence it is necessary to study the effect of growth substances on growth, flowering and corm production in gladiolus cv. White prosperity under Bay Island conditions.

### MATERIALS AND METHODS

The experiment was conducted for two consecutive seasons during November-April of the years 2011-12 and 2012-13 in the Division of Horticulture and Forestry, CIARI, Port Blair, Andaman and Nicobar Islands. Which is situated at the Eastern coast of India in Bay of Bengal (10°30' and 13°42' N latitude and 92°14' and 90°16' E longitude) having a typical tropical and humid climate with annual precipitation of 3086 mm and the recorded relative humidity is about 82%. The congenial climatic conditions of Bay

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Islands are well suited for gladiolus cultivation. Healthy, uniform sized (8-10 cm circumference) corms of gladiolus cv. White Prosperity were planted at a spacing of 30 × 40 cm. The experiment was laid out in RBD and there were three replications in each treatment. In total there were 10 different treatments, viz. T<sub>1</sub>- BA @ 75 ppm, T<sub>2</sub>- BA @ 100 ppm, T<sub>3</sub>- BA @ 125 ppm, T<sub>4</sub>- GA<sub>3</sub> @ 250 ppm, T<sub>5</sub>- GA<sub>3</sub> @ 500 ppm, T<sub>6</sub>- GA<sub>3</sub> @ 750 ppm, T<sub>7</sub>- NAA @ 100 ppm, T<sub>8</sub>- NAA @ 200 ppm, T<sub>9</sub>- NAA @ 300 ppm and control. Corms were dipped in growth substances overnight and shade dried. The crop was grown with all recommended cultivation practices throughout the cropping period. The observations were recorded on various vegetative growth, floral and corm production parameters. Spikes were harvested when basal florets showed colour. Corms were lifted from the soil two months after harvest of spike. Two years data was pooled together and statistically analyzed.

## RESULTS AND DISCUSSION

Results obtained are summarized in Table 1 and 2, analysis of variance revealed that gladiolus cv. White Prosperity at different levels of pre plant corm dipping

treatment by plant growth substances had significant effect on growth, yield and quality parameters of gladiolus spikes and corms.

### *Vegetative growth*

Earliness in corm sprouting was observed by GA<sub>3</sub> at 500 ppm (10.6 days) followed by GA<sub>3</sub> at 750 ppm at (13.7 days) over control (30.6 days). The present results are in conformity with Baskaran and Misra (2007) and Kumar *et al.* (2002) in gladiolus. This may be due to free GA<sub>3</sub> is active in breaking down the reserved food material by hydrolytic enzymes in the presence of sufficient moisture and hence caused earlier sprouting (Vijaykumar and Singh (2005). Another hypothesis is that, it might be through alteration of hormonal balance in favour of promoters or through promotion of alternate respiration. Maximum number of leaves/plant was obtained by GA<sub>3</sub> at 750 ppm (8.2) and minimum was in control (5.3) which was on par with the treatment of BA at 75 ppm and 100 ppm. Number of leaves/plant increased with increasing concentrations of GA<sub>3</sub> followed by NAA 300 ppm (7.3). This may be due to GA<sub>3</sub> exhibited its characteristic effect on shoot

Table 1 Effect of growth substances on growth and flowering of gladiolus cv White Prosperity

Treatment	Days taken for 50% sprouting	Number of leaves	Number of shoots	Plant height (cm)	First flower initiation (days)	Duration of flower (days)	Number of florets	Spike emergence (days)	Spike length (cm)	Rachis length (cm)
BA 75 ppm	20.4	5.6	2.3	69.1	81.0	11.1	8.0	71.7	51.1	32.0
BA 100 ppm	17.0	5.7	3.7	68.8	85.3	12.0	6.0	75.3	53.4	38.2
BA 125 ppm	22.4	6.1	2.7	61.4	93.3	12.5	6.7	80.6	49.4	28.6
GA <sub>3</sub> 250 ppm	16.4	7.6	1.3	93.9	64.5	15.8	11.7	55.0	67.5	46.8
GA <sub>3</sub> 500 ppm	10.6	7.7	1.3	98.9	58.3	17.5	10.3	49.0	70.2	45.0
GA <sub>3</sub> 750 ppm	13.7	8.2	1.7	111.0	65.7	16.2	14.7	56.0	79.3	56.5
NAA 100 ppm	26.4	6.6	2.3	79.4	77.3	14.4	6.7	69.1	59.9	36.9
NAA 200 ppm	23.6	6.9	1.7	85.3	76.4	13.9	7.7	66.5	61.4	36.1
NAA 300 ppm	21.8	7.3	1.5	88.3	71.3	14.7	9.0	62.7	64.3	42.7
Control	30.6	5.3	1.2	72.5	95.0	10.0	5.7	87.0	60.0	40.3
CD (P=0.05)	3.0	0.8	1.24	13.5	6.6	2.6	3.6	5.9	11.1	10.3

Table 2 Effect of growth substances on corm production of gladiolus cv White Prosperity

Treatment	Number of corms/plant	Number of cormels/plant	Wt. of single corm (g)	Wt. of corms /plant (g)	Wt. of cormels/plant(g)	Size of corm (cm)	Volume of one corm (cm <sup>3</sup> )	Propagation co-efficient (%)
BA 75 ppm	3.1	15.6	36.4	111.3	5.6	4.1	44.1	231.2
BA 100 ppm	3.4	19.3	46.9	140.7	7.1	4.6	55.5	297.8
BA 125 ppm	3.4	14.6	43.8	137.4	5.3	4.5	52.0	285.4
GA <sub>3</sub> 250 ppm	2.3	11.6	64.1	135.7	4.9	6.2	73.0	278.5
GA <sub>3</sub> 500 ppm	2.4	14.5	66.6	140.9	6.2	6.3	74.3	296.8
GA <sub>3</sub> 750 ppm	2.7	13.4	77.5	189.1	5.2	7.6	86.3	386.4
NAA 100 ppm	2.4	15.4	45.1	92.6	5.6	4.7	53.4	196.9
NAA 200 ppm	3.1	14.0	50.4	127.7	5.0	4.3	57.3	265.7
NAA 300 ppm	2.7	16.7	54.5	114.1	6.0	5.5	61.5	241.1
Control	1.4	10.4	34.3	41.0	3.7	4.6	40.4	89.1
CD (P=0.05)	0.7	4.2	10.7	18.4	1.5	1.4	11.2	19.5

elongation produced more number of leaves because of extension growth. This increase in number of leaves by NAA might be due to the fact that NAA being a member of auxin group, which promotes vegetative growth by active cell division, cell enlargement and cell elongation. The similar results are reported by Ravidas *et al.* (1992) in gladiolus. More number of shoots/corm was observed by BA at 100 ppm (3.7) whereas minimum numbers of shoots were observed in control (1.2). This may be due to BA broke the dormancy of corm and thereby enhanced sprouting. Another reason may be due to application of BA promotes cell division and shoot differentiation. This might have resulted into increased number of shoots/corm. In general, the plants are treated with GA<sub>3</sub> recorded the maximum plant height where as plants treated with BA at all concentrations recorded minimum plant height. Maximum plant height was recorded by GA<sub>3</sub> at 750 ppm (111.0 cm) and minimum was recorded in BA at 125 ppm (61.4 cm). The enhancement in plant height as a result of application of GA<sub>3</sub> might be due to the fact that GA<sub>3</sub> induced the active cell division and cell elongation (Greulach and Haesloop 1958). Growth might also be increased due to osmotic uptake of water and nutrients under the influence of GA<sub>3</sub>, which maintain swelling force against the softening of cell wall and thereby increasing the plant height (Lockhart 1960). While decrease in plant height with application of BA, might be due to reducing apical dominance. Similar results have been reported by Sindhu and Verma (1998), Maurya and Nagda (2002) and Sharma *et al.* (2004) in gladiolus.

#### Flowering

In general all the flowering characteristics of gladiolus cv. White prosperity showed better results by the corms treated with GA<sub>3</sub> as compared to other treatments. Early spike emergence was recorded by GA<sub>3</sub> at 500 ppm (49.0 days) whereas late spike emergence was observed in control (87.0) which was closely followed by the treatment of BA at 125 ppm (80.6 days). Early flowering was recorded by GA<sub>3</sub> at 500 ppm (58.3 days) whereas late flowering was recorded by control (95.0 days) which was on par with the treatment of BA at 125 ppm (93.3 days). Advanced bud formation and onset of flowering in GA<sub>3</sub> treated plants are attributable to early flowering. This may be due to increased photosynthesis and respiration along with enhanced carbon-dioxide fixation in gibberellic acid treated plants also could responsible for early flowering (Sen and Sen 1968). The results are in line with findings of Baskaran and Misra (2007) and Jhon *et al.* (1997) in gladiolus and Janowska and Andrzejak (2010) in calla lily, Whereas late flowering was recorded by the application of BA. This may be due to the suppression of apical dominance which resulted in delayed flowering. Similarly GA<sub>3</sub> at 500 ppm was found most effective in increasing the flowering duration (17.5 days) and it was found to be minimum (10.0 days) in control. The results are in agreement with the earlier findings by Baskaran and Misra (2007) and Sharma

*et al.* (2004) in gladiolus. The spike length and number of florets/spike are the important characters determining the quality of spike. In this investigation, all the substances significantly influenced these two parameters. GA<sub>3</sub> at 750 ppm recorded the maximum spike length and rachis length (79.3 cm and 56.5 cm respectively). These results are in conformity with Sharma *et al.* (2004) and Baskaran and Misra (2007) in gladiolus. This might be due to the enhanced growth rate of vegetative plant parts in the enhanced physiological activities as influenced by GA<sub>3</sub> which also increases the photosynthetic and metabolic activities causing more transportation and utilization of photosynthetic products (Halevy and Shild 1970). This might have resulted into the better quality spike production. Maximum number of florets/spike was recorded in GA<sub>3</sub> at 750 ppm (14.7) and minimum was recorded in control (5.7) which was closely on par with the treatment of BA at 100 ppm (6.0). Gibberellic acid promotes the auxiliary buds to grow vigorously and their flowering. It might be the main reason for production of more number of florets per spike. The results in this experiment were similar in line with those reported by Mahesh and Misra (1993) and Mohanty *et al.* (1994) in gladiolus.

#### Corm production

Data in Table 2 reveal that all the characters pertaining to corm production were significantly influenced by growth substance treatments. Maximum number of corms and cormels per plant was observed in BA 100 ppm (3.4 and 19.3 respectively) whereas minimum was recorded in control (1.4 and 10.4 respectively) followed by GA<sub>3</sub> treatments. BA promoted the sink activity of developing corm and cormels at the expense of flower spike, this might be the reason for increase in number of corms and cormels and poor quality flower spikes. Similar results were also observed by Havale *et al.* (2007) in gladiolus cv. Jester. Maximum weight of single corm was recorded by GA<sub>3</sub> at 750 ppm (77.5 g). Similarly maximum weight of corms per plant was recorded in GA<sub>3</sub> at 750 ppm (189.1 g) and minimum was recorded in control (41.0 g). Maximum weight of cormels per plant was recorded in BA at 100 ppm (7.1g) and minimum was observed in control (3.7 g). This increase in weight of cormels by BA treated plants might be due to the fact that such plants have built up sufficient food reserves at initial stages due to reduction in plant height. This reserve food has been utilized for cormel development. Maximum size and volume of single corm was also recorded in GA<sub>3</sub> 750 ppm (7.6 cm and 86.3 cc respectively). The increase in weight, size and volume of the corm with application of GA<sub>3</sub> can be attributed to the ability to increase the number of leaves which in turn after thorough photosynthesis, increased the photosynthetic assimilates. These assimilates are transported to the resulting daughter corms, thereby, increasing their weight, size and volume. Regarding corm and cormel production which ultimately affect the propagation co-efficient, GA<sub>3</sub> at 750 ppm as corm dipping for 12 hours gave maximum value of propagation co-efficient

(386.4 %) followed by BA at 100 ppm (297.8 %). Similar findings have also been reported by Kumar *et al* (2002) and Suresh Kumar *et al* (2008) in gladiolus.

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