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Study the effect of plant growth regulators on vase-life of gladiolus: A review

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Abstract
An experiment was conducted to study the Impact of plant growth regulators on growth and flowering of gladiolus cv. Candyman during 2015-16 at Department of Floriculture and Landscape Architecture, IGKV, Raipur. Three growth regulators with three concentration *viz*., NAA (25 ppm, 50 ppm and 100 ppm) GA_3 (200 ppm, 250 ppm and 300 ppm) CCC (150 ppm, 200 ppm and 250 ppm) each at three concentrations in addition to distilled water spray as control comprised ten treatments of this experiment. The experiment was laid out in a Randomized Block Design (RBD) with three replication. All the growth and flowering parameters were periodically observed. The results revealed that the treatment of GA_3 200 ppm (T_4) attributed to superior results regarding the plant height, number of leaves, length of leaves, length of spike, length of rachis, number of floret per spike, diameter of florets, and vase life over all other treatments.

Keywords: Gladiolus, gibberellic acid, NAA, CCC, growth regulator

Introduction
Gladiolus is a flower of glamour and perfection which is 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. Gladiolus is grown as flower bed in gardens and used in floral arrangements for interior decoration as well as making high quality bouquets (Lepcha *et al*., 2007) [3]. Gladiolus is grown on all types of soils having good structure and drainage. It is a winter season crop but can be grown during rainy season in low rainfall areas with mild climate. To enhance of yield and quality of any flower crop various cultural management practices like good planting material, spacing, irrigation, plant protection etc., are required. The planting material i.e. corm is the important factor which governs the growth and development of gladiolus. The physiological functions inside the corms are controlled by plant growth regulators. Plant growth regulators are the organic chemical compounds which modify or regulate physiological processes in an appreciable measure in plants when used in small concentrations. They are readily absorbed and move rapidly through tissues when applied to different parts of the plant. It has generally been accepted that many plant processes including senescence are controlled through a balance between plant hormones interacting with each other and with other internal factors (Mayak and Halevy, 1980) [4]. Although growth retarding chemicals did not increase the number of flowers, they produced flowers with compact shape, developed short stalk, flowers remained fresh for a longer period and they suppressed the height of the plant.It is known fact that application of growth regulators such as CCC, NAA, and GA_3 had positive effects on growth and development of gladiolus plants at different concentrations. The reports indicate that the growth and flowering of gladiolus was enhanced by application of GA_3 (Umrao Vijai *et al*., 2007 and Rana *et al*., 2005) **[12, 7]**, NAA (Kumar *et al*., 2008) **[10]**, CCC by (Patel *et al*., 2010 and Ravidas *et al*., 1992) [1, 12].

Different review of literature
Hence the present study was conducted to find the Impact of plant growth regulators on growth and flowering of gladiolus cv. Candyman. Floriculture refers to the practice of growing flowers. It is an age old field of interest to mankind. Now, floriculture has attained the status of industry due to mass production, assured quality and profitability and inseparable part of human life. Throughout the last decades, it has drawn attention of the scientists having varied interest and has undergone tremendous changes. The general thrust in this area of plant science has all along been to exploit the commercial potentiality of different ornamental plants through improvement of quality and yield of flowers. One of the many approaches has been the application of plant growth regulator chemicals to bring about a change in the growth and flowering patterns of some horticultural crops of ornamental importance.

Some of the well-identified phenomena where plant growth regulators have potential for commercial use are for dwarfing, hastening of flower initiation, prevention of floral abscission, altering the duration of flowering and to increase the yield with improved flower quality.

Effect of plant growth regulators on morpho-physiological parameters of gladiolus

Ravidas *et al*. (1992) [12] studied the effect of foliar application of growth regulators on the growth and flowering of gladiolus cv. Friendship and found that application of 100 ppm GA3 resulted in the greatest plant growth and earliest flowering. However maximum spike length, rachis length and number of floret per spike were obtained with application of 50 ppm GA3.

Mahesh and Mishra (1993) [32] reported that the effect of growth regulators on gladiolus cv. Snow Princess and found that application of 200 ppm GA3 45 days after planting increased the plant height of 87.39 cm while 1000 ppm GA3 increased the number of florets per spike from 10.19 to 10.67.

Mishra *et al*. (1993) reported that GA3 application at 0, 50, 100, 200 and 400 ppm enhanced vegetative growth, flowering and number of corm and cormel produced but adversely affected individual corm weight, GA3 at 200 and 400 ppm reduced the duration of the whole spike. It was concluded that apart from corm size, GA3 at 100 and 200 ppm gave encouraging result.

Mohanty *et al*. (1994) [39] found that in gladiolus cv. Vink's Beauty that 24 hours corm dipping treatment before planting of GA3 @ 50, 100 and 250 ppm showed increased plant height while GA3@ 250 ppm resulted colour break in the basal florets occurred significantly earlier than in control.

Pal and Chowdhury (1998) [44] reported that corms soaked in solutions of growth regulators before 77 days of planting in gladiolus cv. Tropic Sea, soaking for 24 hours in 20 ppm GA3 gave the greatest spike length (91.0 cm), while 12 hours in 40 ppm GA3 resulted in the longest spike field life (16.2 days).

Prakash and Jha (1998) [53] concluded that GA3 @150 ppm improved floral traits in gladiolus cv. Friendship and also produced the longest inflorescence and spikes, with the highest number of florets per spike.

Attia *et al*. (2001) [6] reported that gladiolus cv. Rose Supreme soaked in and sprayed with GA3 @ 50 and 100 ppm increased the number of leaves, fresh and dry weights of leaves, flowering spike length, spike diameter, flowering part length, flowering spike fresh weight, number and fresh weight of florets.

Ram *et al*. (2001) [55] found that pre planting soaking of gladiolus corms in 100 ppm solution at GA3 resulted in earliest flowering, reduced periodicity of flowering and improved longevity of spikes and flowers. Simultaneously he also reported that the length of rachis and spike length, number of florets per spike, length and breadth of florets were also increased.

Kirad *et al*. (2001) [19] reported that the plant growth regulators applied by dipping and spraying resulted in earliest sprouting with GA3 at 100 ppm while sprouting was delayed under CCC treatment and in the control. CCC @ 600 ppm under the dipping + spraying treatment resulted in the maximum number of shoots. GA3 @ 100 ppm (dipping + spraying) showed the highest leaf number. The tallest plant recorded in the treatment with GA3 @ 100 ppm (dipping + spraying) in Gladiolus sp. cv. White Prosperity.

Prasad *et al*. (2002) [54] studied the effect of gibberellic acid (at 0, 250 and 500 ppm) on the growth and flowering of gladiolus. GA3 @ 250 ppm increased plant height, number of leaves, spike length, rachis length and number of floret in Tropic Seas.

Tawar *et al*. (2002) [79] studied the effect of growth regulators on growth and flowering of gladiolus cv. Jester and reported increased plant height, number of leaves per plant, spike length, rachis length, and number of florets per spike with increased dose of GA3 up to 250 ppm.

Gaur *et al*. (2003) [17] found that GA3 @ 200 ppm improved plant height, number and size (width and length) of leaves, thickness and width of shoots, earliness in spike emergence, colour break in the first floret and flowering, increased length of spikes, number of florets per spike, size of floret, longevity of spikes in gladiolus cv. Eurovision.

Kumar *et al*. (2005) [7] found that corms dipping in GA3 @ 200 ppm for 24 hours resulted in increased number of leaves per plant, plant height, days to spike emergence, flowering duration, number of flowers per spike and spike length compared with the control in gladiolus cv. Cong Song.

Rana *et al*. (2005) [7] reported that GA3 @ 100 ppm was recorded the highest values for plant height, number of leaves per plant and length of leaf in gladiolus cv. Candyman

Sharma *et al*. (2006) [69] studied the effect of gibberellic acid levels (0, 100, 200 and 300 ppm) on growth, flowering and corm yield in gladiolus (Red Beauty, Jester and Summer Face). Results revealed that cultivars and GA3 significantly affected all the growth, flowering and corm yield parameters. Earliest sprouting (6.54 and 6.82 6 days) and maximum plant height (100.47 and 102.39 cm), number of leaves per plant (9.49 and 9.68), leaf length (85.00 and 82.80 cm), spike length (73.96 and 75.45 cm), number of florets per spike (18.01 and 16.46), rachis length (62.85 and 60.47 cm), floret length (13.01 and 12.83 cm), vase life (14.33 and 13.70 days) were recorded with GA3 at 200 ppm and 'Red Beauty' cultivar.

Baskaran and Misra (2007) [9] studied the effect of plant growth regulators on growth and flowering of gladiolus and found that the earliness in corm sprouting was observed with GA3 @ 500 ppm followed by GA3 @1000 ppm. Sulphur treatment with GA3 @1000 ppm recorded the maximum plant height. The highest number of leaves per plant was obtained by NAA spraying @250 ppm, followed by NAA@ 100 ppm. Simultaneously maximum spike length, rachis length and number of florets per spike were maximum under cycocel @ 500 ppm.

Ramachandrudu and Thangam (2007) [56] reported in gladiolus cv. White Prosperity that corms dipping in solutions of growth regulators for 24 hours the maximum plant heightwas obtained from 150 ppm GA3 treatment. Treatments withcow urine (20%) + GA3 (100 ppm), 150 ppm GA3 and 100 ppm GA3 recorded advanced flowering (days to spike emergence and flowering) but it was delayed with 100 and 200 ppm NAA compared to the control. 200 ppm NAA, 100 and 150 ppm GA3 recorded prolonged flowering duration when compared to the control.

Singh *et al*. (2007) [79] observed the effect of GA3 on the floral characteristics of gladiolus cultivars Friendship, Tropic Sea, Video, Red Beauty, Legend, Bigtime Supreme, White Prosperity, Oscar, Aldebarn and Venetie. The interaction between Friendship and 150 ppm GA3 was most effective and produced the significantly longest inflorescence. GA3 @ 150 ppm showed increased length and diameter of spikes and the number of florets per spike.

Umrao *et al*. (2007) [12] investigated that the higher levels (100 or 150 ppm) of GA3 increased the number of sprouts per

corm, girth and height of plant, number and width of leaf, length and placement of florets, number of spikes per mother corm, number of opened fresh florets at a time, longevity and vase-life of spike, yield of spikes in gladiolus cv. Nova Lux.

Kumar *et al*. (2008) [10] studied the effect of plant growth regulators *viz*. GA3, NAA, BA, Kinetin and CCC at three concentrations, on growth, flowering and corm production of gladiolus cv. Snow Princess and found that days to 50 percent plants to sprout varied from 9.6 days (T2) to 38.3days (T16). Number of shoots per corm was more (2.4) with T9 followed by T3. Plant height was more with T3 (89.8 cm) while number of leaves per plant was more (8.2) with T5. GA3 500 ppm recorded early flowering (75.9 days) followed by GA3 750 ppm (79.3 days) and NAA 250 ppm (80.1 days). Number of florets per spike, spike length and rachis length were more with T14.

Kumar *et al*. (2010) [24] revealed that 24 hours corm soaking with GA3 @200 ppm recorded early first floret showing colour (84.52 days), full opening of first florets (88.74 days) and full opening of last floret (95.34 days) in gladiolus cv.Candyman.

Patel *et al*. (2011) [52] reported that treatment of GA3@50 mg/l took minimum days for corm sprouting as compared to control and rest of the treatments. Significantly the maximum plant height, leaf length and number of leaves per plant were registered with the same treatment GA3@50 mg/l as compared to control. Sudhakar *et al*. (2012) [75] studied the effect of growth regulators on growth, flowering and corm production of Gladiolus cv. white friendship All the growth parameters were periodically observed. The results revealed that the growth regulators application significantly influenced the growth and yield of Gladiolus sp cv. White friendship. The maximum number of leaves per plant number of florets/spike, spike length (cm) and flower length (cm) were obtained with GA3 @ 200 ppm as compared to rest of the treatments.

Taha *et al*. (2012) [76] studied the effect of different concentrations of gibberellins (GA3), cycocel (CCC) and alar on the growth and flowering of iris plants. In this study the plants of iris were sprayed three times with 0, 250, 500 and 750 ppm of GA3 @ 250, 500 and 1000 ppm of CCC @ 125, 250 and 500 ppm of Alar. Results showed that GA3 @ 750 ppm increased number of flowers, flowering stalk diameter, fresh and dry weights of the flowering stalk, compared to control and other treatments.

Chopde *et al*. (2013) [15] observed that vegetative growth of the plant in respect of plant height, leaf area and spike quality parameters, length of spike and rachis, diameter of spike and florets per spike were recorded maximum in the cv. Phule Ganesh sprayed with GA3 @ 150 ppm. However, minimum period for the first spike emergence and maximum spikes per plant were noticed in cv. Phule Tejas and plants treated with GA3 @ 150 ppm.

Khan and Bahadur (2013) [18] observed that the effect of plant growth regulators found maximum values of plant height (80.78 cm and 82.22 cm in Novalux and White Prosperity, respectively), number of shoots (3.44 in Novalux), number of leaves/plant (20.78 and 20.44 in Novalux and White Prosperity, respectively), minimum days to spike initiation (76.67days) and 78 days in Novalux and White Prosperity respectively minimum days to opening of the first floret (81.67 days in Novalux and 88.67 days in White Prosperity), spike length (81.55cm in Novalux and 82.00cm in White Prosperity), number of florets/spike (23.67 in Novalux and 18.33 in White Prosperity), number of spikes/plant (3.67 in Novalux and 3.11 in White Prosperity) and spike yield /ha (295200 in Novalux and 279900 in White Prosperity).

Montessori *et al*. (2013) [40] reported that number of leaves per plant was more (8.267) with NAA @500 ppm while plant height was more with GA3 @750 ppm (90.133 cm). GA3 @500 ppm recorded early flowering (78.53 days) followed by GA3 @ 750 ppm (83.63 days) and NAA @500 ppm (81.30 days). Spike length (81.23 cm), rachis length (42.06 cm) was more with GA3 @500 ppm while control was found minimum in all parameters. Number of florets per spike (14.30) was recorded with GA3 @750 ppm.

Padmalatha *et al*. (2013) [43] studied the effect of different plant growth regulators on growth and flowering of two gladiolus cultivars Darshan and Dhiraj. The result revealed that the maximum plant height, number of leaves, leaf area, earlier flowering, maximum spike length and number of florets per spike was recorded with treatment of GA3@ 150 ppm.

Patel *et al*. (2013) [50] recorded that the maximum value of plant height (79.2 cm), leaf area (171.3 cm2), Number of leaves (8.7), early emergence of spike (55.7 days), spike length (83.7cm), Number of florets per spike (12.7 cm) and flower diameter (10.9cm), were found with application of GA3@ 300 ppm.

Sarkar *et al*. (2014) [68] studied the effect of four levels of GA3 on gladiolus and concluded that GA3 @ 150 ppm and corm size 120-125 g was more potential to enhance 80% sprouting of corm and initiation of 80% flowering earlier about 3.74 and 5.87 days, respectively and it also increased number of floret inflorescence and diameter of corm compared to control.

Sudhakar and Kumar (2012) [75] conducted the experiment on the effect of growth regulators on growth, flowering and corm production of Gladiolus (*Gladiolus grandiflorus L*.) cv. White Friendship. The results revealed that the growth regulators application significantly influenced the growth and yield of Gladiolus sp cv. White Friendship. The maximum no. of florets/spike, spike length (cm) and flower length (cm) were obtained with GA3 @100 ppm as compared to rest of the treatments.

Aier *et al*. (2015) [1, 2] reported that the morphological characters of gladiolus were significantly influenced by GA3 @ 200 ppm which recorded the highest plant height, number of leaves per plant and leaf area. The treatment GA3 @ 250 ppm recorded the maximum duration of flowering. The treatment with GA3 @ 200 ppm exhibited maximum yield in terms of length of spike, length of rachis, number of florets per spike, diameter of floret, fresh weight, and dry weight of spike.

Sable *et al*. (2015) [65] investigated the effect of plant growth regulators on growth and flower quality of gladiolus and it was found that the maximum height of the plant (59.43 cm), number of leaves (13.9), leaf area (64.8 cm2) were recorded by treatment GA3 @200 ppm foliar spray. In flower quality parameters, maximum number of florets/ spike (13.4), floret length (8.4 cm), length of spike (80.28 cm) and length of rachis (41.50 cm) were recorded with foliar spray of GA3 @ 200 ppm. Maximum weight of floret (10.1 g), diameter of floret (9.5 cm) and girth of spike (2.60 cm) were produced by CCC @ 750 ppm foliar spray.

Sajid *et al*. (2015) [66] investigated the effect of foliar application of gibberellic acid and 6-benzyl amino purine on growth, flowering, post-harvest life and corm production of gladiolus cv. Trader horn. First spray of BAP or GA3 was applied 30 days and the second 60 days after planting at 0, 25,

50 or 100 mg L-1 Results revealed that both the plant growth regulators increased plant height, stalk length, number of florets per spike, fresh weight of florets, compared to the control. However, GA3 significantly increased chlorophyll content and spike length followed by BAP.

Effect of plant growth regulators on vase life of gladiolus

Singh and Kumar (2008) [10] reported that the vase solution treatment combinations of GA3 and BA with sucrose significantly increased the membrane stability index and enhanced the vase life as compared to the sucrose alone treatments (control). Vase solution treatment of GA3 (50 mg/l), followed by BA (50 mg/l) with sucrose (50 g/l) significantly increased solution uptake, fresh weight and dry weight of cut spikes. Treatment of gladiolus cut spikes with 50 mg/l GA3 + 50 g /l sucrose vase solution showed two fold increase in vase life and improved flower quality with a higher number of open flowers per spike at any one time.

Kumar *et al*. (2010) [24] reported that the treatment of 4% sucrose +250 ppm 8-hydroxy quinoline citrate tended to increase the days to basal floret opening (4.72 days), floral size (12.76 and 14.58 cm) of fifth and second floret, respectively, length of spike (9.84 cm), vase life (10.07 days), vase solution uptake (31.30 ml) and longevity of first five florets was registered to be the highest in spikes treated with 4% sucrose + 300 ppm Al2(SO4)3 in gladiolus var. White Prosperity.

Beniwal *et al*. (2011) [11] reported that the effect of floral preservatives on vase life of gladiolus spikes cv. Punjab Dawn. Among all the pulsing treatments except control (with distilled water), Sucrose 5%, Sucrose 5%+AgNO3 (100 mg/l), Sucrose 5% + AgNO3 (200 mg/l), Sucrose 5%+Al2 (SO4)3.16H2O (100 mg/l), Sucrose 5%+Al2 (SO4)3.16H2O (200 mg/l), Sucrose 5%+ Citric acid (100 mg/l) and Sucrose 5%+ Citric acid (200 mg/l), treating of cut spikes with sucrose 5%+Al2 (SO4)3.16H2O (200 mg/l) was found to be the most effective in extending vase life upto 9.50 days, maximum number of florets opening at a time (7.67), solution absorption by cut spikes (64.98 ml) and minimum number of days taken for basal floret opening (2.08 days) as compared to other treatments.

Awasthi *et al*. (2013) [7] reported that the four treatments which contain preservatives has been taken AgNO3 (25ppm), sucrose 2% AgNO3 (25 ppm) + sucrose 2% and distil water (control) denoted as T1, T2, T3 and T4 respectively, for flower treatment. The result indicates that T1 taken minimum day for basal floret open followed by T3. Floret open (%) has been found maximum in T1 followed by T3. The11 T1 indicates as best preservatives in diameter of florets and fresh weight of flower. Our conclusion has been drawn that the T1 found as a best preservatives followed by T3.

Mehraj *et al*. (2013) [36] reported that the vase solutions which contain 100 ppm of sucrose + lemon juice solution (C4) was provided maximum days taken for floret senescence (10.2 days), maximum number of floret opened during floret senescence (9.3 florets), highest longevity (18.3 days) with minimum fresh weight loss (28.2%) whereas minimum days required for floret senescence (4.5days) in C3, 100- ppm sucrose + lemon juice solution was found best to extend the vase life of yellow gladiolus

Kumar and Gupta (2014) [23] reported that sucrose 4 percent and 8-HQC @ 200 ppm as vase solution to increase the postharvest life of cut flower. The plant growth regulators significantly enhanced the postharvest life of cut gladiolus spike. Yield attributes of gladiolus in response to different plant growth regulators.

Ram *et al*. (2001) [55] studied the effect of plant growth regulators on emergence of shoots and yield of corms and cormels in gladiolus and reported that GA3 at 100 ppm hastened the sprouting of corms and CCC at 250 ppm gave maximum yield of corms and cormels in terms of number and weight per plant, weight per corm and cormel and the size of corm and cormel. The minimum yield was obtained with GA350 ppm and in the control.

Maurya and Nagda (2002) [33] observed that spraying with 100 ppm GA3 gave the largest corm (7.42 cm), number of corms per plant (1.87), number of corms per bed (32.3), number of corms per hectare (2.69 lakhs), weight of corms per plant (78.7), weight of corms per bed (1.60), number of cormels per plant (11.9), number cormels per bed (222.3), weight of cormels per plant (4.37) and weight of cormels per bed (76.3) in gladiolus cv. Friendship.

Singh *et al*. (2002) [74] studied the effect of GA3 on corm yield parameters and recorded the number of corms per plant (0.98), corm weight (20.92 g), corm diameter (3.56 cm), number of cormels per plant (4.50), cormel weight (1.34 g), cormel weight per plant (5.91 g) and cormel diameter (1.28 cm) improved with level of GA3 @ 75 ppm in gladiolus.

Kumar and Singh (2005)[7] found that corms dipping in GA3 for 24 hours resulted number of leaves per plant, plant height, days to spike emergence, flowering duration, number of flowers per spike, spike length, number of corms per plant, corm diameter and corm weight were enhanced compared with the control in gladiolus cv. Congo Song.

Bhalla and Kumar (2007) [12] reported that the tallest plants with more number of leaves were produced when the corms were treated with 300 ppm GA3 and longest spikes with maximum number of florets per spike were produced when the corms were treated with GA3 at 300 ppm resulted in increasing the number, size and weight of corms on both the planting dates. This treatment was also effective in producing more number of heavier cormels per plant.

Devi *et al*. (2007) [16] reported that spraying with GA3 @100 ppm resulted highest number of corms per plant (1.68). The maximum corm weight (53.51 g) was recorded with NAA @ 200 ppm sprayed at 6 weeks after planting in gladiolus cv. Jacksonvilla Gold.

Umrao *et al*. (2007) [12] reported that spraying GA3 @ 300 ppm gave the corm diameter (5.28 cm) and weight per corm (22.69 g) while GA3 @ 400 ppm gave number of corms per plant (1.20) in gladiolus cv. Rose Delight.

Baskaran *et al*. (2009) [10] studied the effect of plant growth regulators on corm production in gladiolus cv. Pusa Jyotsana and reported that corm weight was maximum (66.37 g) by dipping with 200 ppm of GA3. While the maximum weight of cormels per plant (6.14 g) and maximum diameter of corms (5.62 cm) was recorded under spraying GA3 @ 500 ppm.

Kumar *et al*. (2009) [20] studied the effect of plant growth regulators on corm and cormel production in gladiolus cv. American Beauty and White Prosperity and reported that NAA @ 150 ppm was recorded maximum corm size (4.66 cm) and corm weight (23.15 g) in cv. White Prosperity.

Patel *et al*. (2011) [52] reported that the treatment of CCC @250 mg/l gave maximum yield of corms and cormels by increasing the number and weight of corms and cormels per plant as compared to control.

Sudhakar *et al*. (2012) [75] studied the effect of growth regulators on growth and yield of Gladiolus sp cv. white friendship. The maximum No. of florets/spike, spike length (cm) and flower length (cm) were obtained with GA3 @ 100ppm as compared to rest of the treatments. Whereas CCC

@500 ppm was found the best in terms of corms and cormels production.

Khan and Bahadur (2013) [18] reported that the application of 100 ppm GA3 gave the maximum corm (1, 17,000) and cormel yield (1.49 t/ ha) followed by GA3 @ 75 ppm in gladiolus.

Sajjad *et al*. (2014) [67] conducted an experiment to find out the effect of different plant growth regulators on Gladiolus plants and conclude that foliar application of 1mM gibberellic acid increased the corm diameter (4.43cm), corm weight (25.34g) and total cormel weight (20.45g) compared to benzyl amino purine and salicylic acid.

Conclusions

Application of GA3 @ 200 ppm corm foliar spray found to be more effective for better performance of different attributes namely plant height, number of leaves per plant, length of leaves, number of days taken to first spike emergence, length of spike, length of rachis, internodal length of floret, number of days taken to first floret open, number of florets per spike, diameter of floret, vase life of cut spike days, number of spike per square meter, diameter of corm per plant. While maximum number of corms per plant, number of cormel per plant, weight of cormper plant, weight of cormel per plant was recorded with the treatment CCC @ 200
ppm.

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