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EFFECT OF BENZYL ADENINE ON GROWTH, YIELD AND FLOWERS OF GERBERA (Gerbera jamesonii)

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ABSTRACT

The effect of benzyl adenine on growth, yield and flowers of gerbera (Gerbera jamesonii) was studied BA (0, 50, 100, 150, 200 and 250 ppm). This study was arranged in complete randomized block design (R.B.D.) with three replicates at the farm and the laboratory of Horticulture department, Allahabad School of Agriculture, SHIATS, Allahabad during October to June 2013. The result indicated that, maximum yield and quality parameters (number of flowers per plant, stalk length, neck diameter and stalk diameter) and number of suckers per plant were observed with treatment of BA at 200 ppm (T5). While, days to first harvest and leaf area index were noticed in 250 ppm BA (T6), and maximum leaf area (dsm2) was recorded by BA at 50 ppm (T2).

KEYWORDS: benzyl adenine, yield, growth, gerbera flowers.

INTRODUCTION

All over the world, the floriculture sector is experiencing rapid changes. Due to globalization and its effects on income generation in different parts of the world per capita consumption of flower in most countries is increasing. When we see global floriculture scenario the United States continues to remain largest flower importer, which imported more than 3,700 million stems, mostly from Colombia and Ecuador (Prasad, 2004). Whereas the domestic floriculture industry is growing at the rate of 7-10 per cent per annum. During 2004 the turnover was Rs.300 crores with Rs. 50 crores contribution from Delhi alone followed by Rs. 45 crores from Bangalore. The industry is characterized by sale of mostly loose flowers and the export surplus from the cut-flower (rose, carnation, gerbera, orchids & anthodium's) industries.

Gerbera belongs to family Asteraceae. This group at present comprises 45 species, native to tropical Asia and Africa. About seven species were recorded in India distributed in temperate Himalayas from Kashmir to Nepal at an altitude of 13,00 to 3,200 meters. Gerbera species of Indian origin are *Gerbera Andria, G.kunzeana, G. languinosa, G. macrophylla, G. nivea, G. ovalifolia and G. poiloselloides.* The cultivated species in this genus are Gerbera asplenifolia, *G. Aurantica, G. kunzeana and G. viridifolia.* These are stem less perennial herbs (Bhattacharjee and De, 2003).

Korkar (2003) indicated that treated some shrubs with kinetin at 100 and 200 ppm improved all growth characters i.e., plant height, number of branches and leaves as well as fresh and dry weights of leaves, stem and roots compared with control for all plant kinds under this study in both seasons.

Youssef (2004) on reported that using the treatment of kinetin applied at 50 and 100 ppm recorded highly increases in plant height, number of leaves per plant and fresh weight of leaf blade in both seasons.

Youssef and Faten (2009) on reported that all tested application of kinetin (50, 100 and 150ppm) scored the highest values of plant height, number of leaves, number of offsets, leaf length, leaf width and leaf fresh weight when compared with untreated plants .

Shuo-TsangChang *ET. al.,* (1999) realized that the contents of endogenous cytokinin in tuberose corms **(***Polianthes tuberosa***)** at vegetative, early floral indication and flower development stages were investigated. We also determined the influence of exogenous cytokinins treatment on the corm apex at three different growth stages in relation to floral initiation and development in tuberose. The exogenous cytokinins effectively induced floral initiation and development, especially at the early floral initiation and flower development stages. Endogenous cytokinins were higher in early floral initiation and development stages in comparison to the vegetative stage. These results indicate that cytokinins seem to promote the development of flower buds rather than inducing flowering in tuberose.

Youssef (2004) reported that the treatment of kinetin at 50 and 100ppm recorded highly increases in number of flowers per plant, fresh and dry weights of floret, the length of flower stalk, the thickness of top flower stalk, fresh and dry weight of flower stalk, Length of flower spathe, width of flower spathe and Fresh and dry weights of flower spathe in both seasons.

Youssef and Faten (2009) reported that kinetin concentrations (50, 100 and 150 ppm) succeeded in improving flowering growth measurements i.e., number of flowers/plants, number of florets/flower, duration of flower on plant, flower length and flower fresh weight in both seasons.

Fukai *ET. al.,* (2005) reported that effects of (BA) benzyladenine on vase life of imported anthodium flowers was examined. Cut anthodium's of two cultivars imported from Hawaiian air-freight were sprayed with 200 micro g.ml. Of BA upon arrival, and vase life of the flowers were evaluated by numerating days before observing apparent discoloration at the distal end of spadix. BA treatment significantly extended the vase life (by Upton 22d) in two cultivars in most cases during summer, but the effect was inconsistent in each cultivar when the test was done in winter. The effect of BA verified in summer was either nullified or significantly diminished by placing 10 flowers together in vase solution. These results indicate that the post importation BA treatment is mostly effective in extending the vase life of cut anthodium's during summer, but may not be reliable during winter in temperate regions.

Moraes *ET. al.,* (2005) found that the effects of benzyladenine on the vase life of heliconia (*H. latispatha*) inflorescences harvested at 2 stages of development. The inflorescences were sprayed with 0, 100, 200 or 300ppm mg benzyladenine/liter harvested at stage characterized by the presence of 1-2 fully opened bracts (stage 1) and 3-4 fully opened bracts (stage 2). The growth regulator was sprayed twice until the stalks were completely wet within the first hour after harvest. The average number of open bracts throughout the vase life was not affected by benzyladenine (2, 5 for stage 1 and 4.2 for stage 2). Treatment with benzyladenine extended flower longevity at both stages of development. Appositive correlation was observed between benzyladenine concentration and increase in vase life. Spraying 300 Mg benzyladenine/liter increased flower longevity by at least 1.8-fold compared to the untreated flowers.

Shabina *ET. al.,* (2005) found that the effect of cytokinins on the senescence and longevity of isolated flowers of day lily *(Hemerocallis pulva)* cv. Royal crown sprayed with cycloheximide. Mature buds were detached from the scopes in the field at 1700 h. one day before a thesis and transferred to 15 ml glass vials containing distilled water. On the subsequent with CH1 (0, 5 mm at 25 degree c) and the other set with plain water. The flowers were transferred to 15 ml glass vials containing 0, 5 mm each of kinetin, BAP (benzyl adenine) and diphenyl urea besides distilled water which served as the control. Kinetin and BAP markedly delayed senescence and prolonged longevity in CH1-Sprayed flowers. The present study reveals that spray treatment of partially open flowers with CH1 followed by transfer to BAP or kinetin were the effective treatments in delaying senescence, maintaining flower quality and there by prolonging longevity of isolated flowers of H. fulva. These treatments also maintain the respiratory pool of sugars in the perianth tissues, besides being effective in slowing down protein degradation with flower opening and senescence.

MATERIALS AND METHODS

The present work was carried out at the farm and the laboratory of Horticulture department, Allahabad School of Agriculture, SHIATS, Allahabad. This work was aimed to study the effects of some pretreatments as growth regulators (BA) as well as their interaction treatments on growth.

- T1: Control treatment (distilled water).
- T2 : Benzyladenine (BA) at 50 ppm

- T3 : Benzyladenine (BA) at 100 ppm
- T4 : Benzyladenine (BA) at 150 ppm
- T5 : Benzyladenine (BA) at 200 ppm
- T6 : Benzyladenine (BA) at 250 ppm

The treatments of the present work was arranged in complete randomized block design (R.B.D.) with three replicates. The initial application for all treatments was begun at 30 days after planting and repeated two times at 3 weeks intervals .Bio new film was used as a surfactant chemical at 0.1 %. Control treatment was sprayed with tap water plus surfactant chemical dissolved in water at the rate of 0.1%.Thus all gerbera plants will be received three application of pervious growth regulators as spray at early morning, the vegetative buds and leaves were sprayed till run off. Plants was sprayed with fungicides (Topspin and Robin) at doses 1g/L and2g/L respectively for two times at weekly intervals. Also all plants was received calcium chelate (100ppm) As spray at the beginning of flowering stage for two times at weekly intervals. Plants was received normal agriculture practices whenever they was needed with care beginning taken to cover all plants parts.

Flowers were harvested when the outer ray florets were completely elongated and two rows of disc florets will be completely developed. They were harvested with side ward pushing of the flower stem at the base. The heel of base was removed and kept in fresh water immediately after harvesting.

The following data will be recorded:

1.1. Sampling procedure

The data was collected on various parameters viz., vegetative, flowering, yield and quality parameters from five plants randomly will be selected in each replication.

1.2. Morphological parameters

- Leaf area
- Leaf area index
- Days taken for sucker production
- Number of suckers per plant

1.3. Flowering parameters

- Days to flower bud emergence
- Days to first harvest
- Days to flower senescence in plants

1.4. Yield and quality parameters

- Number of flowers per plant
- Stalk length
- Neck diameter
- Stalk diameter

EXPERIMENTAL RESULTES

Morphological parameter

Leaf area: The perusal of results from table 1 revealed that leaf area significantly varied with in the treatments, it ranged between 525.03 dsm^2 (T1) and 533.90 dsm^2 (T5). Among the treatments studied T5 registered highest leaf area (533.90 dsm^2), followed by T6 (533.73 dsm^2) and T4 (533.60 dsm^2) which were statistically on par with each other and significantly superior to any other treatments studied.

Leaf area index : A glance of result presented in table 1 reveals that the leaf area index ranged between 4.443 per plant (T1) and 5.13 (T5), it was maximum in T5 (5.13) followed by T6 and T4 (5.126 and 5.12 , respectively) . Minimum leaf area index per plant (4.443) were recorded to be in treatment (T1) .**Days taken for sucker production:** The perusal of data presented in table 1 depicted that the days to sucker production not significantly superior between the treatments. There are no significant differences between the treatments.

Number of suckers per plant: Data compiled for sucker production presented in table 1 revealed that number of sucker production varied significantly among the treatments. The maximum (7.00) number of produced by (T5), which

was statistically and significantly superior over rest of the treatments. Whereas minimum number of sucker production (3.33) was registered in (T1).

Table 1. Effect of Benzyl adenine treatments on leaf area, leaf area index, Days taken for sucker production and Number of suckers per plant

parameters / treatments	Leaf area (dsm^2)	Leaf area index	Days taken for sucker production	Number of suckers per plant
T1	525.03 a	4.443 a	44.67	3.33 a
T2	532.00 b	4.923 b	42.67	4.67 b
T3	533.43 c	5.03 c	42.33	5.33 b,c
T4	533.6 cd	5.12 d	41.67	6.00 c
T5	533.9 d	5.13 d	40.00	7.00 d
T6	533.73 d	5.1126 d	40.67	5.33 b,c
L.s.d 0.05	0.345	0.065	N.S	0.802
F calculate	321.18	54.5	2.178	7.81
F table	3.33	3.33	3.33	3.33

In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly at 0.05 level of significance

Table 2. Effect of Benzyl adenine treatments on flowering parameters

parameters / treatments	Days to flower bud emergence	Days to first harvest	Days to flower senescence in plants
T1	43.33	81.67 c	19.67
T2	42.33	75.00 b	21.00
T3	42.00	74.67 b	21.00
T4	42.33	70.00 a	22.00
T5	40.00	70.00 a	22.00
T6	42.00	67.67 a	21.00
L.s.d 0.05	N.S	2.456	N.S
F calculate	1.66	13.81	1.64
F table	3.33	3.33	3.33

Flowering parameters:

Days to flower bud emergence: The perusal of data presented in table 2 depicted that the days to flower bud emergence not significantly superior between the treatments. There are no significant differences between the treatments.

Days to first harvest : Among the treatments studied (T6) taken (67.67) days to first flower harvesting and found to be statistically on par with T5,T4 (70) days where as (T1) has taken maximum (81.67) number of day for first harvest (Table 2) .

Days to flower senescence in plants: The perusal of data presented in table 2 depicted that the days to flower senescence in plant not significantly superior between the treatments. There are no significant differences between the treatments.

Yield and quality parameters:

Number of flowers per plant : The perusal data presented in table 3 revealed that, the significantly highest (37.00) number of flowers recorded in (T5) and was statistically on par with T4 (36.67) whereas (T1) registered minimum number of flowers per plant (31.33) .

Stalk length: Significant differences were observed among the different treatments. Length of flower stalk was more in T5 (58.36 cm), which was significantly superior over other treatments followed by T4 (57.33 cm) and T3 (55.96 cm). While the shorter stalk length was recorded in T1 (51.48 cm) (Table 3).

Neck diameter of stalk: The treatments varied significantly for the above parameter. T5 was found to be superior with neck diameter (0.630 cm) followed by T4 (0.600 cm) and T6 (0.576 cm). However minimum (0.513 cm) was registered in T1 (Table 3).

Stalk diameter: Stalk diameter varied significantly among the treatments and it was maximum (1.070 cm) in T5, followed by T4 and T6 (1.016 cm). While minimum stalk diameter was recorded in T1 (0.870 cm) (Table 3).

Table 3. Effect of Benzyl adenine treatments on Yield and quality parameters

parameters / treatments	Number of flowers per plant	Stalk length (cm)	Neck diameter (cm)	Stalk diameter (cm)
T1	31.33 a	51.48 a	0.513 a	0.870 a
T2	33.67 b	54.68 b	0.540 b	0.930 b
T3	33.67 b	55.96 c	0.573 c	0.956 c
T4	36.67 cd	57.33 d	0.600 d	1.016 d
T5	37.00 d	58.36 e	0.630 e	1.070 e
T6s	36.00 c	55.51 c	0.576 c	1.016 d
L.s.d 0.05	0.963	0.812	0.0167	0.0242
F calculate	17.048	28.17	20.615	27.757
F table	3.33	3.33	3.33	3.33

In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly at 0.05 level of significance

DISCUSSION

Gerbera is one of the important flower crops grown under greenhouse in India. It is being used as cut flower in decorations and beautification. It has been emerged as an important commercial flower crop under protected cultivation.

Morphological parameter

Vegetative growth is measured in better way in terms of leaf area, leaf area index, days to sucker production and number of sucker per plant and are very much important as they play a key role in deciding the ultimate crop yield. These parameters were also differed within the different treatments of Benzyl adenine studied.

Physiological growth parameters viz. leaf area was maximum in T2,T3 and T5 and leaf area index T6,T5 and T4 were statistically at par with each other and significantly superior over other Benzyl adenine treatments (Table 1) . This might be due to increased number of leaves and plant spread which in turn helped in maintaining higher leaf area and leaf area index, which ultimately might have increased the dry matter production per plant in such superior Benzyl adenine treatments. The results are in agreement with the findings of Nair et al. (2002) and Bhattacharjee (1981). Leaf area index was also recorded maximum in the same Benzyl adenine treatments. It might be due to greater leaf area, which greatly influenced the leaf area index. Besides all the above parameters the next important parameters are days to sucker production and number of sucker production per plant, which directly and positively, associated with the flower yield and other growth parameters. With respect to days to sucker production it not significantly superior between the treatments (Table 1). The T5 produced maximum number of suckers per plant whereas T1 produced very less number of suckers per plant (Table 1). The significant variation with respect to number of sucker production per plant was in accordance with the results obtained by Singh and Ramchandran (2002) and Thomas et al. (2004) in gerbera.

Flowering parameters:

Floral characters include the days to flower bud emergence, days to first harvest and days taken to flower senescence in plant (Table 2). Days to flower bud emergence were not significantly superior between the treatments. There are no significant differences between the treatments the result is in accordance with the findings of Ramesh and Yadav (2003) and Ambar et al. (2001) in studying gerbera cultivars under protected condition. The result for days to first harvest was clearly indicated that, T6, T5 and T4 had taken minimum number of days for first flower harvest while T1 has taken maximum number of days. This is in line with the findings of Kendal et al., (2003) who reported that variation in first harvest among the cultivars due to the genetic makeup of the varieties. After opening of flower head the days taken for flower senescence in the plant itself was also observed and it not significantly superior between the treatments. There are no significant differences between the treatments. The results are in corroborated with the findings of Kumar and Yadav (2003) and Kandpal et al., (2003) in gerbera.

Yield and quality parameters:

Flower yield and its quality parameter decides the significance of the particular Benzyl adenine treatments, which are suitable for commercial cultivation. In the present investigation T5, T4 and T6 produced maximum number of flowers per plant (37.00, 36.67 & 36.00 respectively) (Table 3) and those treatments found to be superior over rest of the treatments studied whereas T1 recorded minimum (31.33) number of flowers per plant. The increased in flower yield might be attributed to the greater leaf area and more number of leaves per plants well as plant spread would have resulted in production and accumulation of maximum photosynthesis, resulting the production of more number of flowers with bigger size. The results are in accordance with the findings of Loser et al. (1986) and Nair and Medhi (2002) in gerbera under protected condition.

Stalk length is very important parameter for gerbera cut flowers. It is one of the characters, which decides the quality cut flowers. Significant differences were observed among the different Benzyl adenine treatments for stalk length. The largest flower stalk was observed in T5, T4 and T3 (Table 3). This result was in accordance of Jeevajothi et al. (2003) who reported that, stalk length increased with the decrease in shade percentage in different cultivars. Ambad

et al. (2001) and Kandpal et al (2003) also reported the variation in stalk length among the genotypes due to the genetic characters of particular genotype.

CONCLUSION

It was revealed from the study that (T5) 200 ppm benzyl adenine increases the plant growth, flower production and flower quality of gerbera.

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