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Studies on the Effect of Dosage and Application Schedule of gibberellic Acid and Benzyl Adenine on Growth Parameters of Gypsophila (*Gypsophila paniculata* L.) cv. Star World

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ABSTRACT: A field experiment was conducted to evaluate the effect of dosage and application schedule of gibberellic acid and benzyl adenine on growth parameters in gypsophila cv. Star World during kharif 2019-2020 at Floricultural Research Station, ARI, Rajendranagar. The soil of experimental plot was sandy loam with good drainage and moderately low water holding capacity. The soil pH is 7.2 and E.C. is 0.27 dSm^{-1}. The available nitrogen of the soil is at 200.30 kg/ha, phosphorous at 45 kg/ha and potassium at 168.75 kg/ha. The experiment consisted of growth regulators GA_3 and BA at 150, 300 and 450 ppm, water spray and two schedules of application at 30 and 45 days after pruning. The experiment was laid out in completely randomized block design with factorial concept with fourteen treatments replicated twice. The experiment results revealed that (G_3S_2) GA_3 at 450 ppm and double spray recorded maximum plant height (98.29 cm), plant spread in E-W direction (54.50 cm), plant spread in N-S direction (51.95 cm), number of nodes (30.66), stalk length (36.25 cm). While maximum number of branches (6.25) were obtained in (G_4S_2) BA at 150 ppm and double spray as compared to rest of the treatments.

Keywords: Gypsophila, gibberellic acid, benzyl adenine, growth parameters.

INTRODUCTION

Gypsophila paniculata L. is species of flowering plant in the Caryophyllaceae family. It is native to Eastern Europe. The genus name is derived from the Greek word gypsos ("gypsum") and philios ("loving"), a reference to the gypsum-rich substrates on which some species grow. Plants of the genus are known commonly as baby's-breath or babe's breath. Gypsophila is an extremely hardy perennial plant and it can substitute many other cut flowers during off season and has enormous potential as a cut flower crop. Flowers are numerous produced in large inflorescences usually in branched panicles. In tropics it is grown in protected structures to produce quality blooms. Gradually, it is gaining lot of popularity among consumers and catching the flower markets. The growing popularity of gypsophila in most of the major cities in India has led to its cultivation as cut flower. Gypsophila is most valued cut flower and is used as important filler material in floral bouquets. The light airy mosses small white or pink flowers make good contrast to large flowers in bouquets.

In recent years, the use of growth regulators in floriculture crop production has undergone enormous change to enhance the yield. The plant growth regulators play an important role in plant growth modifications and development process. Although endogenous growth substances normally regulate the plant growth, exogenous application of plant growth substances bring out modification in growth and development. Growth promoters not only alter the growth parameters, advance blooming, promotes flowering in many ornamentals but also extend the shelf life of many cut flowers. These growth substances improve the physiological efficiency of plants by regulating photosynthesis, transpiration, photorespiration, water and nutrient uptake. It is generally accepted that exogenously applied growth substances show their effects through the alterations in the levels of naturally occurring hormones and it varies with their concentrations used, method of application

and frequency of application on plants. Thus, the use of plant growth promoters has brought a revolution in floriculture industry and has been found to be of great significance in the commercial cultivation of ornamentals crops Mukhopadhyay (1990).

Among plant growth promoters gibberellic acid has significant role in enhancing growth and flowering of ornamental plants. Gibberellic acid (GA_3) has been used to increase the length or height of plants, number of flowers and induce flowering (Medina and Saavedra, 1999; Taiz and Zeiger, 2004). Gibberellic acid may be used to replace vernalization for quick growth, early flower production and enhancement of yield, which may allow the grower to reduce the crop inputs and increase production efficiency (Shillo, 1985). The response of GA treatments in different photoperiod conditions was studied by (Kusey *et al*., 1981) and (Sholmo *et al*., 1985) for Bristol fairy clones in *G. paniculata*. They found a general increase in the number of stems per plant and a higher growth of internodes and stems. The time from planting to visible flower buds appearance and harvest time decreased with gibberellic acid concentration (Karguzel, 2004).

The 6-Benzyladenine (BA), also called 6-benzylaminopurine, is a synthetic cytokinin also known as antisenescent hormone that stimulates cell division in plants and the application of cytokinins (BA) also promotes floral initiation under long day conditions and advances flowering by 2 weeks and also promotes flowering in natural day length conditions in some bristol fairy cultivars of gypsophila (Motoaki *et al*., 1989). Thus, considering the potentialities of plant growth promoters, the present study was conducted to study the response of gypsophila with different growth regulators and schedules of application.

MATERIALS AND METHODS

During the kharif 2019-2020 season, the experiment was carried out at the Floricultural Research Station, Agriculture Research Institute, Rajendranagar, Sri Konda Laxman Telangana State Horticultural University, Hyderabad. The experimental site's soil is sandy loam with a pH of 7.2 and an E.C. of 0.27 dSm^{-1}. The experiment was set up in a Factorial completely randomised block design (FCRD) in an open ventilated polyhouse and included seven levels of treatments: G_1- GA_3 at 150 ppm, G_2- GA_3 at 300 ppm, G_3- GA_3 at 450 ppm, G_4- BA at 150 ppm, G_5- BA at 300 ppm, G_6- BA at 450 ppm, distilled water spray - G_7, and two levels of application schedule. During the experiment, the plants had reached the age of one year, and the observations were made from June 2019 to September 2019, i.e. during one flowering season. The plants were entirely clipped to the ground level at the end of May, 2019. To reduce plant height, pruning was performed after each flush of output. One month after pruning, gibberellic acid and benzyl adenine solutions of 150 ppm, 300 ppm, and 450 ppm were prepared by dissolving 150 mg, 300 mg, and 450 mg in small volumes of distilled water, respectively, and then filling the volume to 1000 ml with distilled water and applying the plant growth regulators solutions twice. The first and second sprayings were applied 30 and 45 days following pruning, respectively (DAP). During the experiment, all necessary cultural activities (such as irrigation, fertilisation, weeding, hoeing, pesticide application, and so on) were carried out. Observations on growth metrics were made one month after the previous spray using established procedures. In each plot, five plants were chosen at random and tagged in order to collect data on growth metrics. The observations were made at 40, 60, and 80 days after spraying, and the gathered data was statistically analysed according to the technique developed by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

A. Plant height

Plant height is one of the most prominent and significant characteristics which influence the vigour and overall appearance of the plant. The mean data pertaining on plant height of gypsophila as influenced by growth regulators, application schedule and interaction effects at 40, 60 and 80 days after spraying is presented in Table 1.

The interaction effects of growth regulators and application schedule had significant effect on plant height. The maximum plant height (95.80, 98.40 and 99.29 cm) was recorded with growth regulator GA_3 at 450 ppm and double spray followed by GA_3 at 450 ppm + single spray (G_3S_2-92.30, 95.90 and 97.70 cm), (G_3S_2) as compared to control (G_7S_1-72.48, 73.80 and 75.90 cm) at 40, 60 and 80 days after spraying respectively. The effect of GA_3 on growth may be due to promoting effect of gibberellins on growth and due to increasing auxin level of tissues or enhance the conversion of tryptophan to IAA which causes the cell division and cell elongation. Similar results of increased plant height were recorded due to GA3 by Dahab *et al.* (1987) in chrysanthemum, Pandey and Chandra (2008) in French marigold, Pranali *et al*. (2015); Kumar *et al*. (2015) in African marigold, Malgorzata *et al*. (2013) in *Ajania pacificia* and Ramesh *et al*. (2013) in tulip.

B. Plant spread (E-W & N-S)

The data furnished in table.1 showed that the plant spread both in East -West and North-South was greatest (45.50, 47.50 and 50.67 cm and 40.50, 46.50, 51.95 cm) in plants treated with GA_3 at 450 ppm and double spray (G_3S_2) which was closely followed by GA_3 at 300 ppm + double spray. The increase in plant spread in both directions (E-W and N-S) in gypsophila might be due GA_3 resulted in hyper elongation of internodal length which caused extension in plant height while increase in total count of main axis consequently increased number of dormant buds from where primary branches originated which result in optimum spread of plant which are in accordance with Dahab *et al.* (1987) in chrysanthemum and Pranali *et al*. (2015) in African marigold.

Table 1: Effect of dosage and application schedule of GA_3 and BA on growth parameters in gypsophila cv. Star world.

Treatments	PLANT HEIGHT (cm)			PLANT SPREAD (E-W) (cm)			PLANT SPREAD (N-S) (cm)			NUMBER OF BRANCHES			NUMBER OF NODES			STALK LENGTH (cm)
	40 DAYS	60 DAYS	80 DAYS	40 DAYS	60 DAYS	80 DAYS	40 DAYS	60 DAYS	80 DAYS	40 DAYS	60 DAYS	80 DAYS	40 DAYS	60 DAYS	80 DAYS	
G_1S_1	80.20	82.80	88.56	37.36	40.70	41.10	31.71	33.66	36.50	3.81	4.20	5.35	21.70	23.89	25.00	24.50
G_1S_2	87.20	87.80	94.40	39.57	42.00	43.50	37.59	41.20	42.16	3.90	4.59	6.10	23.39	24.10	25.60	25.62
G_2S_1	90.56	91.46	92.23	44.70	46.16	49.96	35.98	41.60	45.26	3.86	4.60	4.89	23.90	25.64	29.20	25.75
G_2S_2	90.60	96.99	98.00	45.46	49.16	50.36	40.05	42.56	44.57	4.31	4.84	5.87	25.44	27.55	30.50	27.25
G_3S_1	92.30	95.90	97.70	45.40	47.50	50.67	38.56	43.13	46.30	4.36	4.89	5.66	25.70	26.64	29.50	31.00
G_3S_2	95.80	98.40	99.29	45.50	49.36	54.50	40.50	46.50	51.95	4.60	5.27	6.20	26.50	27.75	30.66	36.25
G_4S_1	78.50	85.30	89.50	40.60	41.90	43.10	28.90	38.56	40.18	5.20	5.90	6.25	21.20	24.00	26.05	18.62
G_4S_2	80.80	84.90	86.40	41.60	44.26	47.10	37.59	41.41	47.70	5.70	6.10	6.80	22.49	25.30	27.30	21.50
G_5S_1	82.55	86.46	91.70	41.20	46.16	47.10	33.90	39.50	44.60	4.24	4.79	5.60	22.90	24.70	27.60	21.26
G_5S_2	87.26	88.90	96.70	45.36	47.57	49.00	37.75	41.52	48.45	4.49	5.10	6.14	23.49	26.28	30.10	22.50
G_6S_1	78.10	79.10	83.70	40.05	44.50	46.00	33.54	39.40	43.50	3.99	4.70	5.50	22.20	24.64	25.81	21.38
G_6S_2	82.00	85.63	87.10	44.92	46.96	50.08	36.80	40.70	45.19	4.26	4.89	5.60	21.60	24.30	25.50	20.00
G_7S_1	72.48	73.80	75.90	31.90	33.50	36.50	24.50	30.50	35.79	3.71	3.80	4.40	20.70	21.20	23.37	14.50
G_7S_2	72.60	74.70	76.40	33.80	35.18	37.12	29.90	32.50	36.10	3.73	4.00	4.50	21.00	22.50	24.15	15.50
S.E m±	0.61	0.58	0.41	0.49	0.24	0.26	0.38	0.74	0.88	0.10	0.08	0.22	0.15	0.21	0.39	0.70
C.D	1.87	1.77	1.26	1.50	0.71	0.79	1.16	2.24	2.66	0.31	0.26	0.66	0.43	0.63	1.19	2.11

G_1S_1 :GA_3 150 ppm + single spray G_3S_1: GA_3 450 ppm + single spray G_5S_1: BA 300 ppm + single spray G_7S_1: Control1 (water single spray)
G_1S_2: GA_3 150 ppm + double spray G_3S_2: GA_3 450 ppm + double spray G_5S_2: BA 300 ppm + double spray G_7S_2: Control 2 (water double spray)
G_2S_1:GA_3 300 ppm + single spray G_4S_1: BA 150 ppm + single spray G_6S_1: BA 450 ppm + single spray
G_2S_2: GA_3 300 ppm + double spray G_4S_2: BA 150 ppm + double spray G_6S_2: BA 450 ppm + double spray
Where BA- Benzyl adenine, GA_3- Gibberellic acid

C. Number of branches

Data presented in the Table 1, tabulated that among the treatments maximum number of branches (5.70, 6.10 and 6.80) was recorded in the plants treated with BA at 150 ppm + double spray (G_4S_2) followed by GA_3 at 450 ppm + double spray (G_3S_2-4.60, 5.27 and 6.20), whereas minimum number of branches was recorded in control (G_7S_1-3.71, 3.80 and 4.40). The increase in number of branches in gypsophila with BA might be due to increase in plant biomass especially in terms of development and production of lateral buds which in due course of time developed into side shoots/branches. Similar, results of increase in number of branches have been reported by Soach *et al*. (2002) in carnation, Baskaran and Misra (2007) in gladiolus, Ibrahim *et al.* (2010) in croton.

D. Number of nodes

The maximum number of nodes (26.50, 27.75 and 30.66) was recorded in the plants sprayed with growth regulator GA_3 at 450 ppm and double spray (G_3S_2) followed by GA_3 300 ppm + double spray) while minimum number of nodes was recorded in control (G_7S_1-20.70, 21.20 and 23.37). The role of gibberellic acid in increasing the number of nodes in gypsophila may be attributed due to cell elongation leading to enhanced elongation of stem, photosynthates might have been diverted toward the process for the sustenance of the elongated stems. The results are in accordance with Ramesh *et al*. (2001); Nandre *et al.* (2009) in china aster.

E. Stalk length

The interaction effects of growth regulators and application schedule on stalk length was found significant and presented in Table 1. The maximum stalk length of (36.25 cm) was reported in plants sprayed with GA_3 at 450 ppm + double spray (G3S2) followed by GA_3 at 450 ppm + single spray (G_2S_2-31cm) while minimum stalk length was reported in control (G7S1-14.50 cm) with single spray of water. The increment in stalk length with higher concentration of GA_3 in gypsophila might be due to cell division and longitudinal growth of the cell and plant as a result stalk length and plant height increased simultaneously. Similar findings of maximum stem length was obtained by Dahab *et al.* (1987); Kohl and Kofranek (1957) in chrysanthemum and increase was greater by increasing GA_3 concentration. Mynett (1979) also reported that GA_3 stimulated stalk elongation in carnation and Singh (1966) reported increased stem length in pansy and cinereria with GA_3.

CONCLUSION

Based on the above findings among the interactions foliar application of GA_3 at 450 ppm + double spray and BA at 150 ppm + double spray was proved most effective in increasing the growth parameters of gypsophila.

FUTURE SCOPE

In continuation of the present investigation, the following further work can beproposed for producing higher flower yield in Gypsophila.

Studies can be carried out on the other treatments combination of other growth regulators and bio stimulants in Gypsophila.

Studies can be carried out by using locally available home made preservatives to improve vase life in Gypsophila.

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Conflict of Interest. None.

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