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Effect of growth regulators on growth and flowering of tuberose cv. single

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ABSTRACT

The present experiment was conducted at the Horticulture farm of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka, to study the effect of growth regulators on the growth and flowering of tuberose during the period from 01 May 2005 to 30 April 2006. Three different treatments of growth regulators (GA3, Ethrel and control) as foliar application were used for this purpose. Data were collected on flower yield and yield contributing character. The results demonstrated that foliar application of growth regulators had significant effect on the parameters studied except number of floret in 100 gm. GA3 showed better performance in respect of plant height but ethrel slightly reduced plant height compared to the control. GA3 and ethrel showed better performance in case of number of leaves per plant over control. Growth regulators influenced number of side shoot/plant. Maximum number of side shoot per plant 16.61 was obtained from GA3, while the least number of side shoot per plant (12.19) was found in control. The highest height of the side shoot was found 53.86 cm from GA3 while lowest height of side shoot 49.00 cm was found from ethrel tretment. The maximum number of leaves 14.96 was obtained from the plant treated with GA3 which is the least in control (12.15). The plants sprayed with GA3 initiated spike earlier (77.5 days) but it was 82.56 days in control. The maximum duration of flowering (18.13 days) was obtained from plants treated with ethrel while minimum duration of flowering (15.55 days) was found in the control. Length of the spike both for mother plant and for side shoot, including length of rachis increased with the increase of the bulb size and application of GA3. GA3 gave the highest spike diameter (0.99 cm) while minimum spike diameter (0.86) was obtained from the control. GA3 gave the maximum weight of single spike (39.00 gm) but control treatment (35.66 gm) was found to be inferior to the all other treatments. GA3 produced the maximum number of florets per spike (43.32) while the minimum number of floret per spike (38.91) was found from control. GA3 produced the highest number (380.59 thousands) of spike/ha while minimum number of spikes/ha (339.05 thousands) was in control treatment. The highest yield (15.00 t/ha) was obtained from the treatment GA3 but the control plants produced the lowest yield of spike per hectare (12.40 ton/ha).

Introduction

Tuberose is a native of Mexico from where it spread to the different parts of the world during 16th century. How and when the tuberose found its entrance to India, Ceylon and elsewhere in the Orient is probably an unanswerable question (Yadav and Maity, 1989). Nowadays, it is cultivated on large scale in France, Italy, South Africa, USA and in many tropical and subtropical areas, including India and Bangladesh.

Normal plant growth and development are regulated by naturally produced chemicals or endogenous plant hormones. Their role can often be substituted by application of synthetic growth regulating chemicals. These are becoming extremely important and valuable in the commercial control of crop growth in both agriculture and horticulture (Nickell, 1982). Many studies have indicated that the application of growth regulators can affect the growth and development of flowers.

There are many factors which can affect plant growth and economic cultivation of tuberose. Growth and developmental behaviour of bulbous plant is regulated either by a single or by an interaction of several endogenous growth hormones like Gebberellin, Ethylene, Auxin, Cytokinin and Abscisic acid (ABA) (Bose and Yadav, 1998.)

Application of certain growth substances has been found to influence the growth and flowering of tuberose (Bose and Yadav, 1998). Mukhopdahyay and Banker (1983) sprayed the plants of cv. Single with GA_3 and observed that GA_3 increased spike length and flower number per spike. Duration of flowering in the field was improved with GA_3. According to Dhua et al. (1987), treatment with GA_3 caused earliest flowering and gave the maximum yield of spikes and flowers. Nagaraja et al. (1999), conducted an experiment in which highest plant height was obtained using GA_3 while ethrel resulted in earlier plant emergence, a higher percentage of sprouting and earlier flowering compared to the control.

In Bangladesh, no studies have been done regarding the use of growth regulators for growth and flowering of tuberose. So, research work on

widely cultivated type Single is still lacking in the country. The present study was, therefore, undertaken to determine the effect of growth regulators on growth and flowering of tuberose cv. Single.

Materials and Methods

The experimental site was a medium high land and pH of the soil was 5.6. The morphological characters of the soil of the experimental plots were AEZ No. 28, soil series- Tejgaon and general soil-Non-calcarious dark grey (Source: Soil Resources Development Institute, Farmgate, Dhaka). In this experiment foliar application of growth regulators like GA3: Gibberellic Acid (200 ppm), ET : Ethylene (Ethrel) (200 ppm) were used.

Preparation of GA_3, Ethrel and control solutions

Gibberellic acid (GA_3)

A 1000 ppm stock solution of GA_3 was prepared by dissolving 1 gm in a small quantity of ethanol prior to dilution with distilled water in 1 litre of volumetric flask. The stock solution was used to prepare the 200 ppm concentration, 200 ml of this stock solution was diluted in 1 litre of distilled water to get 200 ppm GA_3 solution. A few drops of tween 80 was added to all solution including the control as an wetting agent. GA_3 was collected from LOBA CHEMIE PVT LTD. Mumbai, India.

Ethrel

Ethrel was collected from Wilson Laboratories, Mumbai, India in the form of concentrated solution (Laboratory Grade), which was used to prepare stock solution containing 1000 ppm. This was used to prepare fresh solution of 200 ppm ethrel for the experiment. 200 ml of this stock solution was diluted to 1 litre of distilled water to prepare 200 ppm solution. A few drops of tween 80 were added to all solution including the control as a wetting agent.

Control solution

A control solution also prepared only by adding a small quantity of ethanol with distilled water.

Foliar application of growth regulators

Growth regulators and control solution were applied 30, 55 and 80 days after planting by using hand sprayer.

Data collection

Plant growth contributing characters were measured as per method described elsewhere (Akand et al., 2016). Flower yield and yield contributing character were measured following the standard procedure (Akand et al., 2016).data were analyzed and the mean for the treatments was calculated and analysis of variance for each of the characters was performed by F (variance ratio) test. The differences between the treatment means were evaluated by LSD test at 1% or 5% probability.

Results and Discussion

Plant growth contributing characters

Plant height

The variation in plant height due to the effect of growth regulators was significant. The highest plant height (60.2 cm) at 200 DAP was obtained from the plant treated with GA_3 followed by control (58.15 cm) (Fig. 1). Ethrel treatment (55.78 cm) was found to be inferior to all other treatments in respect of plant height. The observed results are in agreement with the findings of Nagaraja et al. (1999) and Wankhade et al. (2002).

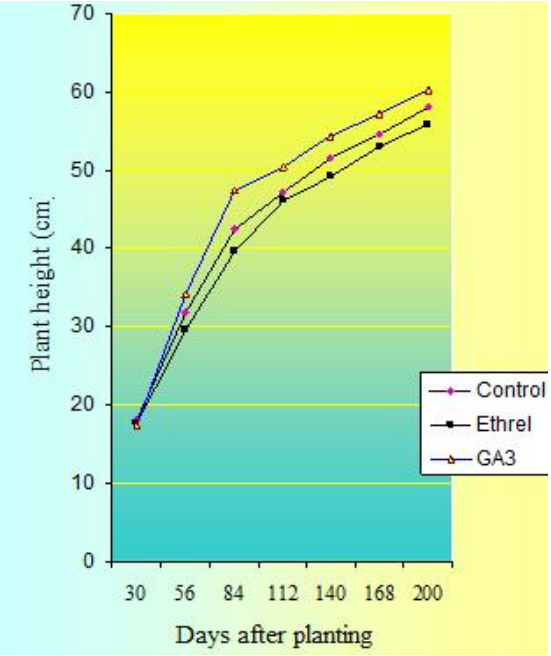

Figure 1. Effect of growth regulators on plant height of tuberose

Number of leaves/plant (mother bulb)

The growth regulators had significant effect on the number of leaves per plant. The maximum number of leaves (20.01) was obtained from the plant treated with GA_3 followed by ethrel (18.28) (Fig. 2). All the treatments showed better performance over control (17.2). Wankhade et al. (2002) found similar result.

Number of side shoots per plant

There was significant variation among the different growth regulators in respect of number of side shoot per plant. The maximum number of side shoot per plant (16.61) was obtained from plants treated with GA3 followed by Ethrel (14.20). The minimum number of side shoot per plant (12.19) was found in the control (Table 1).

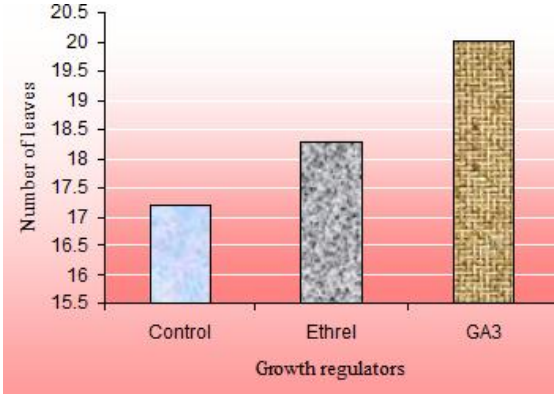

Figure 2. Effect of growth regulator on number of leaves per plant tuberose

Height of the side shoot

The effect of growth regulators on the height of the side shoot was found to be significant. The highest height of the side shoot (53.86 cm) was obtained from the plant treated with GA_3 followed by Control (49.26 cm) (Fig. 3). Ethrel treatment (49.00 cm) was found to be inferior to all other treatments. The observed results are in agreement with the findings of Nagaraja et al. (1999).

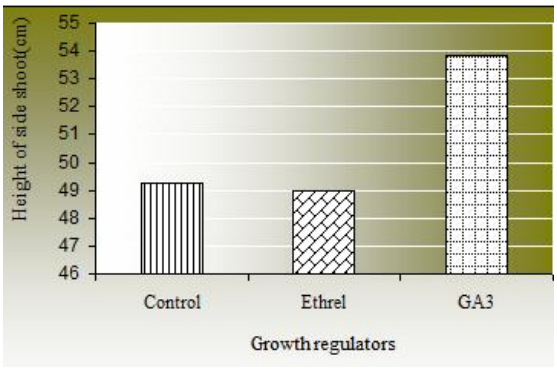

Figure 3. Effect of growth regulators on height of side shoot

Number of leaves/side shoot

The average number of leaves produced by the side shoot was significantly influenced by the growth regulators. The maximum number of leaves (14.96) was obtained from the plant treated with GA_3 followed by ethrel (13.31) which has been shown in Table 1. All the treatments showed better performance over control (12.15).

Days to spike emergence

The time required to spike emergence was influenced by the plant growth regulators and the effect was statistically significant. The plants sprayed with GA_3 initiated spike earlier (77.5 days) followed by ethrel (79.59 days) whereas it was 82.56 days in control (Table 1). Tiwari and Singh (2002) found similar results.

Days to first flowering

The time required to first flowering was influenced by the plant growth regulators and the effect was statistically significant. The plants sprayed with GA3 flowered earlier (15.91days) followed by ethrel (16.91 days) whereas it was 18.20 days in control (Table 1). This has similarities with the finding of Rama Swami et al., (1979).

Table 1. Main effect of growth regulators on number of side shoot/plant, Number of leaves/side shoot, Days to spike emergence and Days to first flowering of tuberose cv. Single

Treatment	Number of side shoot/ plant	Number of leaves/ side shoot (cm)	Days to Spike emergence	Days to first flowering
Control	12.19	12.15	82.56	18.2
Ethrel	14.2	13.31	79.59	16.91
GA_3	16.61	14.96	77.5	15.91
LSD 1%	4.66	0.25	0.26	0.39
LSD 5%	3.38	0.18	0.19	0.28

Duration of flowering

There was significant variation among the different growth regulators in respect of duration of flowering. The maximum duration of flowering (18.13 days) was obtained from plants treated with ethrel followed by GA_3 (17.50 days). The minimum duration of flowering (15.55 days) was found in the control (Fig. 4). Nagaraja et al. (1999) found similar result.

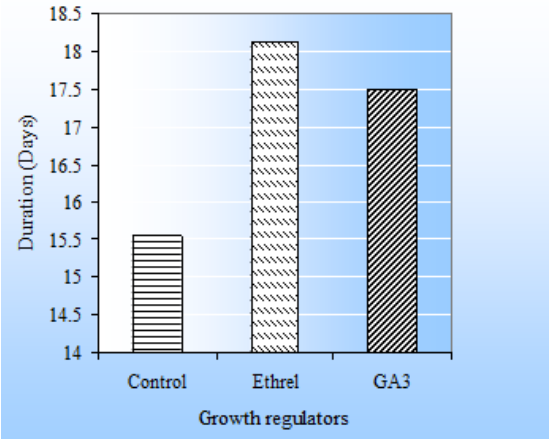

Figure 4. Effect of growth regulator on duration of flowering

Flower yield and yield contributing character

Length of spike (mother bulb)

Growth regulators had significant effects on the length of spike. The highest spike length (74.39 cm) was obtained in the plants treated with GA_3 followed by ethrel (71.74 cm) whereas the minimum length (70.55 cm) was found from the control treatment (Fig. 5). Figure 6 shows the effect of different growth regulators on length of spike of tuberose.

The present results are in agreement with the findings of Mukhopadhay and Banker (1983).

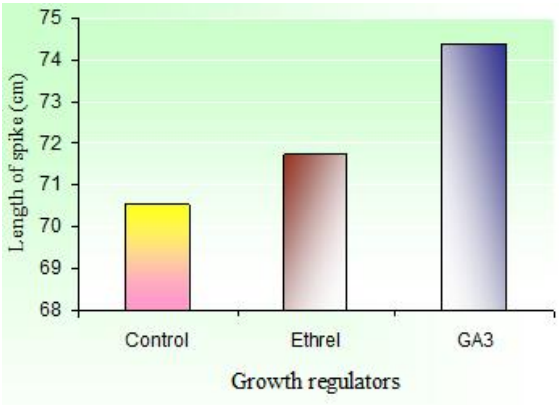

Figure 5. Effect of growth regulators on the length of spike

Figure 6 . Effect of growth regulators on length of spike of tuberose

Length of spike (side shoot)

Growth regulators had significant effects on the length of spike. The highest spike length (71.29 cm) was obtained from the plants treated with GA_3 followed by ethrel (68.68 cm) whereas the length was minimum (67.81 cm) in control (Table 2).

Diameter of the spike (mother bulb)

There was significant variation among the growth regulators. GA_3 gave the highest spike diameter (0.99 cm) followed by ethrel (0.96 cm). Minimum spike diameter (0.86 cm) was obtained from the control (Table 2). Wankhede et al. (2002) found that GA_3 increases the diameter of the spike.

Weight of the single spike (mother bulb)

There was significant difference among the different growth regulators in respect of average weight of spike. GA_3 gave the maximum weight of single spike (39.00 g) followed by ethrel (37.80 g). Control treatment (35.66 g) was found to be inferior to all other treatments (Table 2).

Length of the rachis (mother bulb)

The different growth regulator treatments had significant effect on the length of rachis. The highest rachis length (18.16 cm) was obtained from plants treated with GA3 followed by ethrel (16.85 cm) as shown in Table 2. Manisha et al. (2002) found similar results.

Length of the rachis (side shoot)

The different growth regulators had significant effect on the rachis length of the side shoot. The highest rachis length (15.94 cm) was obtained from plants treated with GA3 followed by ethrel (14.07 cm) as shown in Table 2. It was found minimum (13.28 cm) in control.

Number of floret/spike (mother bulb)

There was significant variation among the different growth regulator treatments in respect of number of florets per spike. The maximum number of florets per spike (43.32) was obtained from plant treated with GA3 followed by ethrel (40.27). The minimum number of floret per spike (38.91) was found in the control (Table 2). Mukhopadhyay and Banker (l983) found similar result.

Table 2. Main effect of growth regulators (Control, Ethrel and GA3)on flowering of tuberose cv. Single.

Treatment	Length of spike (Side shoot) cm	Diameter of the spike (mother bulb) cm	Weight of the single spike (mother bulb) gm	Length of the rachis (mother bulb) cm	Length of the rachis (Side shoot) cm	Number of floret/spike (mother bulb)	Number of floret/spike (Side shoot)	Number of floret in 100 gm	Number of spikes/ha (thousand
Control	67.81	0.86	35.66	15.89	13.28	38.91	34.89	137.5	339.05
Ethrel	68.68	0.96	37.8	16.85	14.07	40.27	36.51	132.87	353.96
GA3	71.29	0.99	39	18.16	15.94	43.32	39.81	128.35	380.59
LSD 1%	0.27	0.04	0.27	0.26	0.26	0.25	0.27	14.27	0.27
LSD 5%	0.19	0.03	0.19	0.19	0.19	0.18	0.20	10.35	0.20

Number of floret/spike (side shoot)

There was significant variation among the different growth regulator in respect of number of florets per spike. The maximum number of florets per spike (39.81) was obtained from plant treated with GA_3 followed by Ethrel (36.51). The minimum number of floret per spike (34.89) was found in the control (Table 2).

Number of floret in 100 g

The effect of growth regulators in respect of number of floret in 100 gm was found to be insignificant. However, the lowest number (128.35) of floret in 100 gm was obtained from the GA3 treatment, which was highest (137.50) in case of control (Table 2).

Number of spikes/ha (thousands)

Growth regulator significantly influenced the production of spikes/ha. Plant treated with GA_3 produced the highest number (380.59 thousands) of spike/ha followed by ethrel (353.96 thousands). The minimum number of spikes/ha (339.05 thousands) was obtained from the control treatment (Table 2). The result had similarities with the findings of Manisha et al. (2002).

Flower yield/ha (tons)

The yield of spike per hectare was significantly different among the different growth regulator treatments used. The yield of spike per hectare increased with the application of GA_3 but decreased in the control treatment as shown in Fig. 7. Thus, in case of spike per hectare, the highest yield (15.00 t/ha) was obtained from the treatment of GA_3 followed by ethrel (13.57 ton/ha) and the control plants produced the lowest yield of spike per hectare (12.40 ton/ha). Manisha et al. (2002) also found similar results.

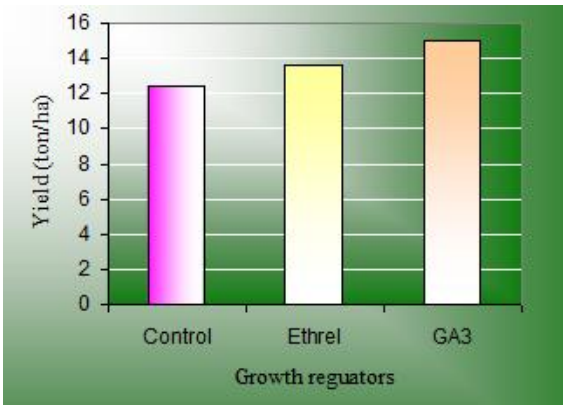

Figure 7. Effect of growth regulator on the flower yield of tuberose

The results obtained from the present investigation suggested that GA_3 showed increased vegetative growth and flowering. However, further trials should be done on similar soil and climatic condition before recommending it to the growers.

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