Published with Open Access at Journal BiNET
Vol. 12, Issue 01: 1016-1020
Journal of Bioscience and Agriculture Research
Journal Home: www.journalbinet.com/jbar-journal.html

Effect of plant growth regulators on growth and flowering of tuberose (Polianthes tuberosa L.) cv. Single

M. R. Amin[1], N. Pervin[1], A. Nusrat[1], H. Mehraj[2,3] and A. F. M. Jamal Uddin[1]

[1]Dept. of Horticulture, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh
[2]The United Graduate School of Agricultural Science, Ehime University, Ehime 790-8556, Japan
[3]The Lab of vegetable and Floricultural Science, Kochi University, Kochi 783-8502, Japan

✉ For any information: ask.author@journalbinet.com, Available online: 14 February 2017.

ABSTRACT

A field experiment was conducted to study the effect of plant growth regulators on growth and yield of tuberose (Polianthes tuberosa L.). Treatments of the experiment were as control (No plant growth regulators), NAA 100 ppm, NAA 200 ppm, NAA 300 ppm, NAA 400 ppm, GA_3 100 ppm, GA_3 200 ppm, GA_3 300 ppm, GA_3 400 ppm, 4-CPA 100 ppm, 4-CPA 200 ppm, 4-CPA 300 ppm and 4-CPA 400 ppm. Different concentration of growth regulators showed significant variation on most of the parameters. Tallest tuberose plant (68.9 cm), longest length of rachis (21.9 cm), highest number of floret/spike (41.2), highest diameter of spike (1.1 cm), maximum weight of single spike (40.1 g) and highest number of spikes per hectare (3.9 lac) were obtained from GA_3 at 300 ppm.

Key Words: *Polianthes tuberosa, GA_3, NAA and CPA.*

Cite article: Amin, M.R., Pervin, N., Nusrat, A., Mehraj, H. and Jamal Uddin, A.F.M. (2017). Effect of plant growth regulators on growth and flowering of tuberose (*Polianthes tuberosa* L.) cv. single. Journal of Bioscience and Agriculture Research, 12(01), 1016-1020.
Crossref: https://doi.org/10.18801/jbar.120117.123

I. Introduction

Tuberose (*Polianthes tuberosa* L.), an ornamental bulbous plant native to Mexico, is one of the most important cut flowers in tropical and subtropical areas. It belongs to the family Amaryllidaceae. Tuberose occupies a very selective and special position to flower loving people. It has a great economic potential for cut flower trade and essential oil industry. The spikes are useful as cut flowers in vase decoration and bouquets; while individual floret is used for making veni, garland, button-holes or crown. It has a delightful fragrance and is the source of tuberose oil. The natural flower oil of tuberose is one of the most expensive raw materials for perfume [9]. Normal plant growth and development are regulated by naturally produced chemicals or phytohormones. Their role can often be substituted by application of synthetic growth regulating chemicals or hormones. The potential use of growth regulator in flower production has created considerable scientific interest in recent years. Many studies have indicated that the application of growth regulator can stimulate the growth and

Published with open access at journalbinet.com
EISSN: 2312-7945, © 2017 The Authors, Research paper

development of flowers. Plant growth regulators are known to coordinate and control various phases of growth and development, including flowering at optimum concentrations. It is generally accepted that exogenously applied growth substances act through the alteration in the levels of naturally occurring growth regulators, thus modifying the growth and development of the plant. Hence, the present study was undertaken to study the effects of plant growth regulators on growth and flowering of tuberose.

II. Materials and Methods

The experiment was conducted at the Horticultural farm of Sher-e-Bangla Agricultural University, Dhaka, Bangladesh during the period from April 2009 to February, 2010. The experiment was designed to study the effect of different growth regulator like as NAA (Naphthalene Acetic Acid), GA_3 (Gibberellic Acid) and 4-CPA (Chlorophenoxy Acetic Acid), and their different concentrations on growth and flower production of tuberose. The experiment comprised with control (No plant growth regulators), NAA 100 ppm, NAA 200 ppm, NAA 300 ppm, NAA 400 ppm, GA_3 100 ppm, GA_3 200 ppm, GA_3 300 ppm, GA_3 400 ppm, 4-CPA 100 ppm, 4-CPA 200 ppm, 4-CPA 300 ppm, 4-CPA 400 ppm. The single factors experiment was laid out in randomized complete block design with 3 replications. The bulbs were planted in 4 cm depth in furrows on 24 April 2009. Spacing was maintained by 30 cm x 20 cm respectively and the size of each plot was 1.6 m x 1.2 m. Treatments were applied three times at 20, 50 and 80 days after planting by using hand sprayer. General intercultural operations weredone during growing period as and when necessary. Data were collected on different growth and yield related parameters and the recorded data was statistically analyzed using MSTAT-C program to find out the significance of variation resulting from the experimental treatments. The mean for the treatments was calculated and analysis of variance for each of the characters was performed by F test. The differences between the treatment means were evaluated by DMRT test [3].

III. Results and Discussion

Plant height

Maximum plant height (68.9 cm) was recorded from GA_3 @ 300 ppm which was closely followed by GA_3 @ 200 ppm (66.7 cm) and the minimum (39.7 cm) was obtained from control (no growth regulator). Plant height increased in GA_3 treated plants than in NAA and 4 CPA treated plant (Table 01). The effect of gibberellins on growth may be due to increasing auxin level of tissue or enhance the conversion of tryptophan to IAA which causes the cell division and cell elongation. Similar results were also reported by Shankar et al. (2010) and Kumar and Gautam (2011) in tuberose using GA_3 [8]; [4].

Number of leaves

Maximum number of leaves (24.8/plant) was recorded from concentration of GA_3 at 300 ppm which was followed by NAA at 200 ppm (22.4/plant) while minimum number of leaf (13.8) was recorded in control (Table 1). Treatment with GA_3 promoted the height of all plants and increased the number of leaves per plant. The results are in accordance with the findings of Manisha et al. (2002) and Kumar and Gautam (2011) in tuberose [5]; [4]. Singh (1999) found that highest number of leaves per plant (27.4) using GA_3 at 200 ppm [10].

Number of side shoots

Maximum number of side shoot (12.1/plant) was recorded from 300 ppm of GA_3 which was followed by NAA at 200 ppm and the minimum (7.8/plant) was obtained from control (Table 01). Wankhede et al. (2002) and Singh et al. (2008) found that highest number of shoots per plant with 200 ppm GA_3 concentration [13]; [11].

Side shoot height

Maximum height (59.5 cm) of side shoot per plant was recorded from GA_3 at 300 ppm which was followed by NAA at 200 ppm (53.2) and 4CPA at 300 ppm (52.7). On the other hand the minimum (36.4 cm) was found from control condition (Table 01).

Numbers of leaves per side shoot

Maximum number of leave per side shoot (23.1) was recorded from concentration of GA_3 at 300 ppm. On the other hand the minimum number of leaves per side shoot (11.8) was observed in the plot with control condition (Table 01).

Spike length

Longest spike (72.6 cm) was found from concentration of GA_3 at 300 ppm. On the other hand the shortest spike (52.2 cm) was recorded from control condition (Table 02). Increased spike length might be as a result of rapid internodes elongation due to increase cell division and cell elongation in intercalary meristem. Similar result was also reported by Shanker et al. (2010) and Tiwari and Singh (2002) in tuberose [8]; [12].The enhancement in spike length might have resulted from increased cell division and elongation [2]. Increased spike weight might be due to the fact that these spikes had more number of florets per spike with increased length and diameter.

Rachis length

Longest rachis (21.9 cm) was recorded from the concentration of GA_3 at 300 ppm which was statistically identical with concentration of NAA @ 200 ppm (21.4 cm) and shortest (14.3 cm) was obtained from control condition (Table 02). Devadanam et al. (2005) found that GA_3 gave maximum rachis length [1].

Number of florets

With the increasing of concentration of growth regulators number of floret per spike performed an increasing trend (Table 02). The highest number of floret (41.2/spike) was recorded from concentration of GA_3 at 300 ppm.On the other hand the lowest number of floret (15.6/spike) was observed in control condition. Preeti et al. (1997) and Singh (1999) found highest number of floret per spike by using GA_3 at 200 ppm [7]; [10]. Favorable effect of GA_3 might be attributed due to greater amount of carbohydrate accumulation and increase metabolic activities.

Spike diameter

Different concentration of growth regulators showed a statistically variation on diameter of spike under the present trial. With the increases of concentration of growth regulators, diameter of spike showed an increasing trend up to 300 ppm and thereafter declined (Table 02). Widest (1.1 cm) spike was recorded from concentration of GA_3 at 300 ppm which was statistically similar (1.0 cm) at 200 ppm concentration of NAA. On the other hand the thinnest (0.7 cm) spike was observed in control condition. Wankhede et al. (2002) reported that spraying of GA_3 at 200 ppm showed significant increase in diameter of spike in tuberose [13].

Spike weight

Different levels of growth regulator showed a gradual increasing trend in terms of weight of spike up to 300 ppm and thereafter declined (Table 02). The maximum weight of spike (40.0 g) was obtained from GA_3 at the concentration of 300 ppm which was statistically (36.0 g) similar with NAA at 200 ppm and the minimum weight of single spike (25.1 g) was recorded from control. Increased weight of spike in plants treated with 300 ppm GA_3 was mainly due to increased number of florets per spike and increased diameter of spike. Singh et al. (2008) expressed similar results in tuberose [11].

Number of spike

Maximum number of spikes (748.4 per plot) was obtained from GA_3 @ 300 ppm followed by NAA @ 200 ppm (729.6/plot) whereas minimum from control (499.2/plot) (Table 02). The differences in spike yield per plot showed significantly varying among the treatments. This increase in number of spikes per plant in turn can be attributed to increase of shoots per plant in the respective treatments.Highest numberof spikes (3.9 lac/ha) was recorded from GA_3 at 300 ppm which was closely followed by NAA at 200 ppm (3.7 lac/ha) and the minimum (2.6 lac/ha) was obtained from control (Table 02). Similar result was also reported by Shanker et al. (2010) in tuberose [8]. Pathak et al. (1980) found the maximum yield of spikes by treating with GA_3 at200 ppm [6].

Published with open access at journalbinet.com
EISSN: 2312-7945, © 2017 The Authors, Research paper

Table 01. Effect of different growth hormones and tconcentrations on growth of tuberose

Treatment	Plant height (cm)	Leaves/plant	Side shoot/plant	Side shoot height (cm)	Leaves on side shoot
Control	39.6 e	13.8 h	7.8 f	36.4 g	11.8 f
NAA at 100 ppm	42.9 de	17.5 g	9.3 e	45.9 def	20.2 cde
NAA at 200 ppm	50.1 bcd	22.4 ab	11.2 b	53.2 b	21.2 b
NAA at 300 ppm	63.4 ab	19.6 def	9.9 de	49.5 f	21.6 bcd
NAA at 400 ppm	55.4 abc	19.9 cdef	10.3 cd	42.4 ef	19.0 de
GA_3 at 100 ppm	50.1 bcd	21.2 bc	9.3 e	46.0 def	19.5 de
GA_3 at 200 ppm	66.7 a	21.0 cd	11.0 bc	51.6 bcd	21.2 bcd
GA_3 at 300 ppm	68.9 a	24.8 a	12.1 a	59.5 a	23.1 a
GA_3 at 400 ppm	59.9 ab	18.5 fg	10.5 bcd	43.7 cf	20.3 bc
4 CPA at 100 ppm	43.7 de	21.2 bc	10.5 bcd	48.6 f	19.8 de
4 CPA at 200 ppm	46.2 cde	20.3 cde	10.6 bcd	47.4 bf	19.2 de
4 CPA at 300 ppm	51.0 bcd	19.2 ef	10.7 bc	52.7 bc	20.0 de
4 CPA at 400 ppm	50.9 bcd	20.0 cde	10.5 bcd	49.3 be	18.9 e
CV (%)	*5.3*	*3.2*	*3.7*	*4.9*	*4.8*
LSD	*7.7*	*0.6*	*0.7*	*3.2*	*1.7*

In column, means followed by same letter(s) do not differ significantly at 5% level of probability.

Table 02. Effect of different growth hormones on the flowering characteristics of tuberose

Treatment	Spike length (cm)	Rachis length (cm)	Florets / spike	Spike diameter (cm)	Single spike weight	Spikes/ plot	Spikes/ hac
Control	52.2 f	14.4 e	15.6 f	0.7 c	25.1 e	499.2 j	2.6 h
NAA at 100 ppm	56.5 e	15.1 d	17.2 f	0.7 c	28.0 ed	576.0 h	3.0 f
NAA at 200 ppm	66.9 b	21.5 a	40.3 a	1.0 a	36.0 b	729.6 b	3.8 a
NAA at 300 ppm	64.3 b	19.6 b	32.3 b	0.8 b	32.0 d	691.2 d	3.6 b
NAA at 400 ppm	60.6 cd	16.0 d	28.4 cd	0.8 b	31.7 d	652.8 f	3.4 d
GA_3 at 100 ppm	61.9 c	16.5 cd	29.2 c	0.8 b	33.5 d	672.0 e	3.5 bcd
GA_3 at 200 ppm	64.7 b	19.3 b	29.3 c	1.0 a	33.7 d	710.4 c	3.7 b
GA_3 at 300 ppm	72.7 a	21.9 a	41.2 a	1.1 a	40.1 a	748.8 a	3.9 a
GA_3 at 400 ppm	60.6 c	16.7 c	27.4 d	1.0 a	35.4 b	672.0 e	3.5 bc
4 CPA at 100 ppm	60.2 c	17.1 c	23.6 e	0.8 b	31.7 d	556.8 i	2.9 g
4 CPA at 200 ppm	65.9 b	17.8 c	23.6 e	0.8 b	32.5 d	614.4 g	3.2 e
4 CPA at 300 ppm	58.8 d	16.5 cd	22.5 e	0.8 b	32.1 d	672.0 e	3.5 bcd
4 CPA at 400 ppm	59.3 cd	16.9 c	23.3 e	0.8 b	32.5 d	652.8 f	3.4 d
CV (%)	*2.8*	*2.7*	*4.5*	*6.0*	*4.6*		*3.7*
LSD	*2.2*	*0.9*	*1.6*	*0.1*	*3.2*	*0.5*	*0.1*

In column, means followed by same letter(s) do not differ significantly at 5% level of probanility.

IV. Conclusion

GA3 is the most effective plant growth regulator for growth and flowering of tuberose. Spraying of GA_3 @ 300 ppm provided the best growth and flowering of tuberose cv. Single.

Acknowledgement

Authors are thankful to Ananda Nursery, Savar Bazar, Dhaka, Bangladesh for providing the bulbs of tuberose cv. single.

V. References

[1]. Devadanam, A., Shinde, B. N., Sable, P. B. and Vedpathak, S. G. (2005). Effect of foliar spray of plant growth regulators on flowering and vase life of tuberose (Polianthes tuberose L.). J. Soils and crops, 17(1), 86-88.

[2]. Dutta, J. P., Ramadas, S. and Khader, M. A. (1993). Regulation of flowering by growth regulators in chrysanthemum (Chrysanthemum indicum L.) cv. Co-1. South Indian Horticulture, 41, 293-299.

[3]. Gomez A. K. and Gomez A. A. (1984) Statistical procedures for agricultural research. 2nd Ed., John Wiley and Sons, Inc., NY. pp. 8-20.

[4]. Kumar, A. and Gautam, D. K. (2011). Effect of plant growth regulators on vegetative growth and flowering behavior of tuberose Hyderabad double. Plant Archives,11(2), 919-921.

[5]. Manisha, N., Syamal, M. M., Narayan, M., Misra, R. L. and Sanyat, M. (2002). Effect of gibberellic acid on tuberose. Floriculture Res. Trend in India.National Symposium on Indian Floriculture. Bangalore. p. 350.

[6]. Pathak, S., Choudhuri, M. A. and Chatterjee, S. K. (1980). Effect of bulb size on growth and flowering of tuberose. Indian J. Plant. Physiol. 23, 47-54.

[7]. Preeti, H., Gogoi. S., Mazumder, A. and Hatibarua, P. (1997). Effect of pre-plant chemical treatment of bulbs on growth and flowering of tuberose cv. Single. Annals of Bio. Ludhaiana, 13(1), 145-149.

[8]. Shanker, K., Singh, A. K. and Singh, H. K. (2010). Effect of plant growth regulators on spike yield and bulb production of tuberose double. Plant Archives, 11(1), 169-171.

[9]. Sharga, A. N. and Sharma, S. C. (1994). Commercial cultivation of tuberose. In: Prokash, J. & Bhandary, K. R. (Eds.), Floriculture Tech. Tradesand Trends, Pub. Mohan Primlani for Oxford IBH Publishing Co. Pvt. Ltd. Delhi, India. pp. 160-167.

[10]. Singh, A. K. (1999). Response of tuberose growth, flowering and bulb production to plant bioregulators spraying. Prog. Hort. 31(3-4), 181-183.

[11]. Singh, P. K., Singh, S. N. and Singh, D. B. (2008). Response of GA3 and NAA on growth, flowering, bulb production and vase life of tuberose (*Polianthes tuberosa* L.) cv. Single. Asian J. Hort. 3(1), 183-186.

[12]. Tiwari, J. K. and Singh, R. P. (2002). Effect of preplanting GA3 treatment on tuberose. J. Orn. Hort. 5(2), 44-55.

[13]. Wankhede, S. G., Beiorkar, P. V., Mohariya, A. D., Alurwar, M. W., Rathod, K. G. and Gawande, P. P. (2002). Influence of bulb soaking and foliar spray of GA3 on growth, flowering and yield of tuberose (*Polianthes tuberosa*). J. Soils and Crops, 12(1), 105-107.

Published with open access at journalbinet.com
EISSN: 2312-7945, © 2017 The Authors, Research paper