Int.J.Curr.Microbiol.App.Sci (2018) *7*(9): 1622-1626

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 7 Number 09 (2018)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2018.709.194

Regulation of Growth and Flowering in Tuberose with Application of Bio-Regulators

Sangram S. Dhumal*, Manpreet Kaur, Pradeep Dalave, Vishnu K. Garande, Ravi D. Pawar and Shriram S. Ambad

Department of Horticulture, College of Agriculture, Kolhapur-416004, Maharashtra, India

**Corresponding author*

Keywords

Tuberose, Phule Rajani, Bioregulators, GA_3, IBA, Growth, Flowering

Article Info

Accepted:
10 August 2018
Available Online:
10 September 2018

A B S T R A C T

The effect of different levels of GA_3 (40, 80, 120 and 160 ppm) and IBA (20, 40, 60 and 80 ppm) on the regulation of growth and flowering in Tuberose cv. Phule Rajani was studied. The bioregulators were applied as dip treatment of tuberose bulbs for 24 hrs before planting and as a spray 30 day after planting. The application of bioregulators; soaking as well as spraying, was found to be effective in manipulating the growth and flowering traits as compared to control. Soaking of the tuberose bulbs in 160ppm GA_3 solution for 24 hours before planting significantly increased plant height (53.73cm) with highest number of leaves per plant (33.17) and width of leaf (23.97mm). It also registered minimum number of days for spike emergence (59.67). Significant increase in length of spike (63.77cm) and rachis (28.19cm), maximum number of spikes per plant (3.57), florets per spike (24.54), number of bulbs per plant (10.07), bulblets per plant (19.32), weight of bulbs per plant (194.62 gm) and highest vase life (9.87 days) was recorded in dipping treatment of tuberose bulbs in 160ppm GA_3 for 24 hours before planting which was followed by the treatments; spraying with 160 ppm GA_3, soaking in 80 ppm IBA and spraying of 80ppm IBA 30 days after planting.

Introduction

Tuberose (*Polianthes tuberosa* L.), an ornamental bulbous plant, is commercially grown for its attractive and luring cut flowers in tropical and subtropical areas of country. It has an enormous economic potential for cut flower trade and essential oil industry. As per area and production statistics of the National Horticulture Board, the total area under tuberose cultivation in the country is about 7.95 lakh hectares. Tuberose planted at a spacing of 30 x 30cm with a plant population of 1,11,000 plants/ha yield about 90,000 marketable spikes and 1.8 lakhs flowering size bulbs. This traditional flower crop of Indiablooms throughout the year and its clustered spikes are rich in fragrance; florets are star shaped, waxy and loosely arranged on spike that can reach up to 30 to 45 cm in length. 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, thereby contributing in export earnings.

Increased demand for its cut-flower and aesthetic use has led to improvisation in cultural practices with sole aim of enhancing yield and quality of tuberose plant. Exogenous application of plant growth regulators is being practiced by the commercial growers as a part of cultural practice to improve the different economically important and market desirable characteristics of this flower plants. Sarkar *et al.,* (2009) reported increased no. of bulb per plants, weight of individual bulb and total bulb yield when different growth regulators (NAA and IBA) were applied as dip treatment under north Indian conditions.GA_3 is the most effective plant growth regulator for growth and flowering of tuberose at a concentration of 300 ppm (Amin *et al.,* 2016). Mukhopadhyay *et al.,* (1983) found that the plant height was reduced with ethrel spray at high concentration and spike length and floret numbers per spike was increased with GA_3 application under Bangalore conditions. Plant response to foliar application of plant growth regulators (PGRs) is often variable, in part due to environmental factors. High humidity and longer drying time often are also reported to increase PGR uptake in laboratory studies (Stover *et al.,* 2005).

Therefore there is need to investigate the effective concentrations of PGR and their response under varied environmental conditions of country for optimizations of technique. This study entitled "effect of application of bio-regulators on growth and flowering of Tuberose var. 'Phule Rajani' was carried out at the field of Horticulture section, college of Agriculture Kolhapur where average temperature varies between 23^0C to 31^0C over the year. The objective of this study was to find the effect of bio-regulators on the regulation of growth and flowering in Tuberose cv. Phule Rajani under Kolhapur conditions of Maharashtra state of India.

Materials and Methods

The experiment entitled "Effect of application of bio-regulators on growth and flowering of Tuberose var. 'Phule Rajani' " was carried out at the field of Horticulture section, college of Agriculture Kolhapur during the year 2009-10. Healthy bulbs of tuberose var. Phule Rajani of uniform size were planted at the spacing of 30 x 30 cm. The experiment was laid out in Randomized Block Design with three replications.

The soaking was done 24 hours before planting and spraying was done 30 days after planting. Tuberose varieties 'Phule Rajani was used for the study (2009-2010). The bulbs were procured from the Department of Horticulture, MPKV, Rahuri MH. Healthy Bulb sized about 2.0 cm were used as planting material. The chemicals used in experiment were gibberellic acid (GA_3) and indole-3-butryric acid (IBA).The experiment considered 17 treatment of soaking and spraying of GA_3 and IBA respectively. The treatments comprise four levels of GA_3 (40, 80, 120 and 160 ppm) and four levels of IBA (20, 40, 60 and 80 ppm) respectively. Sufficient volume of a particular growth regulator solution was used for soaking of bulb and then bulbs were dried overnight under ambient conditions before planting. Different parameters were recorded pertaining to growth, flowering and bulb production.

Results and Discussion

Effect of GA_3 and IBA on vegetative growth

Data presented in Table 1, showed increased height, no of leaves per plant, and width of leaf with different concentrations of growth regulators when compared with control. The

maximum number of leaves per plant (33.17), plant height (53.73), and width of leaf (23.97) was recorded with soaking treatment at 180ppmfollowed by spraying of 160 ppm GA_3 in the cultivar Phule Rajni. GA_3has been applied to improve various characteristics in tuberose plant including the plant height [Shankar *et al.,* (2010); Kumar and Gautam, (2011) and Amin *et al.*, (2011)] and number of leaves [Shradha *et al.,* (*2002*) and Singh, (1999)]. The effect of gibberellins on growth characteristics may be due to the cell elongation and rapid cell stimulation in the bulbs and increasing auxin level of tissue or enhance the conversion of tryptophan to IAA which causes the cell division and cell elongation [(Amin *et al.*, (2011)].

Minimum day (59.42) for spike emergence was recorded from spraying GA_3 at 160 ppm concentration. Soaking bulb in GA_3 at 180 ppm concentration recorded maximum spike length (63.77cm) which was in significance with control (57.71cm) (Table. 1). These results were in accordance with the findings of Jana and Biswas (1979) and Mukhopadhyay and Bankar (9) in tuberose; and Bhattacharjee (3) in gladiolus. Increased cell division and elongation as accelerated by PGR application might resulted in increased spike length as reported by Shanker *et al.,* (2010) and Tiwari and Singh (2002) in tuberose.

Maximum rachis length was obtained with GA_3 at concentration of 180 ppm which was in conformity with Devadanam *et al.,* (2005).

Table.1 Effect of application of bio-regulators on growth characteristics Tuberose var. 'Phule Rajni'

Treatments	Leaves per plant	Height of plant (cm)	Width of leaf (mm)	Days for spike emergence	Length of spike (cm)	Length of rachis (cm)
T_{1}- Control	23.33	47.37	18.31	64.38	57.71	**23.67**
T_{2}- GA3 40 ppm	28.43	50.63	20.83	62.86	59.88	**24.13**
T_{3}- GA3 80 ppm	31.12	51.87	20.09	62.98	60.75	**25.48**
T_{4}- GA3 120 ppm	32.02	51.09	22.94	61.09	62.28	**26.95**
T_{5}- GA3 180 ppm	33.17	53.73	23.97	59.67	63.77	**28.19**
T_{6}- IBA 20 ppm	27.31	51.79	19.73	63.49	58.69	**24.67**
T_{7}- IBA 40 ppm	31.98	51.36	19.91	62.72	60.91	**24.78**
T_{8}- IBA 60 ppm	30.37	51.18	20.60	62.30	61.79	**25.32**
T_{9}- IBA 80 ppm	30.79	52.57	20.96	61.65	62.37	**27.76**
T_{10}- GA3 40 ppm	29.39	50.92	19.61	62.88	59.09	**25.31**
T_{11}- GA3 80 ppm	30.51	51.28	20.89	62.73	61.38	**26.39**
T_{12}- GA3 120 ppm	32.01	51.15	19.93	60.91	61.02	**27.83**
T_{13}- GA3 160 ppm	32.98	53.03	22.37	59.42	63.38	**28.11**
T_{14}- IBA 20 ppm	27.67	50.91	20.08	63.79	59.45	**24.34**
T_{15}- IBA 40 ppm	29.06	51.89	20.39	62.31	61.86	**25.65**
T_{16}- IBA 60 ppm	30.15	51.39	19.57	61.85	62.92	**26.98**
T_{17}- IBA 80 ppm	30.74	52.14	20.49	60.17	62.14	**27.37**
`F' test	Sig.	Sig.	Sig.	Sig.	Sig.	**Sig.**
SE (m)+	0.421	0.502	0.373	0.569	0.538	**0.409**
CD at 5%	**1.276**	**1.523**	**1.132**	**1.725**	**1.632**	**1.215**

Table.2 Effect of application of bio-regulators on floral attributes of Tuberose var. 'Phule Rajni'

Treatments	Spikes per plant	Florets per spike	Vase life (Days)	Bulbs per plant	Bulblets per plant	Wt. of bulbs per plant
T_{1}- Control	1.67	19.33	7.34	5.76	11.56	125.32
T_{2}- GA3 40 ppm	2.34	20.89	8.37	7.89	14.67	153.76
T_{3}- GA3 80 ppm	2.87	22.79	9.07	9.23	17.22	162.17
T_{4}- GA3 120 ppm	3.18	22.16	9.19	9.74	18.01	181.89
T_{5}- GA3 180 ppm	3.57	24.54	9.87	10.07	19.32	194.62
T_{6}- IBA 20 ppm	2.13	21.98	8.68	7.13	13.87	149.89
T_{7}- IBA 40 ppm	2.24	21.67	8.32	8.22	15.11	161.78
T_{8}- IBA 60 ppm	2.31	22.47	8.66	8.87	16.02	167.12
T_{9}- IBA 80 ppm	2.37	23.82	9.09	9.33	17.94	171.81
T_{10}- GA3 40 ppm	2.18	21.33	8.38	6.87	13.33	157.98
T_{11}- GA3 80 ppm	2.43	22.18	8.67	7.54	14.05	165.09
T_{12}- GA3 120 ppm	2.61	23.97	9.34	7.37	14.55	179.93
T_{13}- GA3 160 ppm	3.29	24.18	9.69	9.97	19.01	189.11
T_{14}- IBA 20 ppm	2.04	21.37	8.37	6.02	13.09	139.98
T_{15}- IBA 40 ppm	2.18	22.34	8.77	6.11	13.37	142.63
T_{16}- IBA 60 ppm	2.39	22.61	8.88	7.23	13.92	159.88
T_{17}- IBA 80 ppm	2.41	23.67	9.04	8.94	14.72	168.91
`F' test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
SE (m)+	0.017	0.375	0.267	0.249	0.374	2.361
CD at 5%	0.052	1.137	0.811	0.755	1.134	7.154

Effect of GA_3 and IBA on flowering

Significant improvement was observed in floral and bulb characteristics viz. spikes per plant, florets per spike, vase life, bulbs per plant, bulblets per plant and weight of bulbs per plant after PGR application when compared with control. Maximum numbers of spike per plant were registered with soaking bulbs in GA 180 ppm which was statistically identical with spraying GA 160 ppm.

Maximum no. of floret per spike (24.54) was observed at 180 ppm soaking of GA and the minimum number of floret/ spike (19.33) in control treatment. Among the different PGR applications, GA_3treatmentat 160ppmshowed the highest vase life of 9.67 days which was in accordance with Mukhopadhyay and Bankar (1983). The favorable effect of GA_3 might be due to the fact that it accelerates carbohydrate accumulation and increases metabolic activities in the plants as reported by Singh *et al.*, (2003)

The number of bulbs and bulblets per plant of tuberose significantly affected with growth regulators used in this study. High level of GA_3 application led to increase in no. of bulb, bulblet and weight of bulb per plant. The maximum number of bulbs per plant (10.7) was recorded at 180ppm GA_3 dip treatment followed by soaking of bulb in GA_3application at 160 ppm. Bulblets per plant (19.32) and weight of bulb per plant (194.62) were also maximum at 180ppm GA_3treatment. Similar results were reported by Mukhopadhyay and Bankar (1983) and Tonecki *et al.*, (1979) in gladiolus and Sarkar *et al.*, (2009) in tuberose (Table 2).

Soaking treatment with GA_3 at 180ppm significantly improved the different growth and floral characteristics in tuberose over the other PGR treatments studied in this experiment. Soaking treatment at 180ppm was found statistical identical with spraying treatment of GA_3 at 160 ppm for most of the studied floral and bulb parameters.

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How to cite this article:

Sangram S. Dhumal, Manpreet Kaur, Pradeep Dalave, Vishnu K. Garande, Ravi D. Pawar and Shriram S. Ambad. 2018. Regulation of Growth and Flowering in Tuberose with Application of Bio-Regulators. *Int.J.Curr.Microbiol.App.Sci.* 7(09): 1622-1626.
doi: https://doi.org/10.20546/ijcmas.2018.709.194