Original Research Article

EFFECT OF PLANT GROWTH REGULATORS ON GROWTH AND FLOWER YIELD OF LILUM (*Liliumlongiflorum L.) cv.Eremo*UNDER POLYHOUSE IN PRAYAGRAJ AGRO CLIMATIC CONDITION

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ABSTRACT:Effect of Plant Growth Regulators on Growth and Flower Yield of Lilum (*Liliumlongiflorum L.*) cv.. EremoUnderPolyhouse in Prayagraj Agro Climatic Condition". was carried out at the Sam Higginbottom University of Agriculture, Technology, and Sciences at Prayagraj's Department of Horticulture.. During rabi season (2021-2022). The experiment was layout in Randomized block design (RBD) with 13 treatments and each treatment replicated thrice. The treatments consist of different combinations of plant growth regulators (IAA, Ethrel and GA3). The treatment T10 (GA3@200ppm) was found the statistically significant compared to other treatment combination, which recorded highest plant height (71.36 cm), Number of leaves (72.36), plant spread (15.44 cm2), Days to first flower bud initiation (44.33 days), days of first flower initiation (50.07 days), flower stalk diameter (6.55 mm), number of buds per inflorescence (4.66), Bud length (11.59 cm), Bud diameter (17.07 mm), Flower diameter (16.26 mm), Vase life (10.55 days), Number of spike yield per plant (2.23), number of spike yield per hectare (77142.59 lakh), followed by T8 (Ethrel@550ppm).

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Keywords:Lilium, IAA, Ethrel, and GA$_3$plant growth regulators.

1.INTRODUCTION

There are over 100 species and over 9,400 cultivars in the genus Lilium, which is part of the Liliaceae family. These cultivars are classified into seven categories. Northern hemisphere, mainly Asia, North America and Europe, especially China, Nepal, Korea and Japan, constitute the gene centres of this genus around the world. Lilium sp. is cultivated worldwide and is one of the most important generator cut flower and pot plant. It is a genus of great economic significance for production and commercialization of its cut flower in the international cut flower market. In the language of flowers, lily symbolizes purity and innocence.

It is currently one among the most important flowers farmed for the cut flower market. Due to its size, beauty and longevity, lilium is among the top ten cut flowers in the world . As a cut flower, lily is the fourth most important crop in the Netherlands. Species of genus lilium, originated from Asia, Europe, and North America, are mostly vegetatively propagated monocot perennials and are one of the economically most important flower bulbs. Lilies produce big attractive flowers with a wide range of colours and shapes,

therefore, they make excellent cut flowers, wonderful flowering potted plants and have a great ornamental value for landscape purposes.

Worldwide commercially important lily cultivars, viz. Asiatic hybrids, Oriental hybrids and cultivars of Liliumlongiflorum, originated from only three of the seven sections. Asiatic hybrids were obtained after complex interspecific hybridization between at least 12 species of the Sinomartagon section. Hybridisation between five species of the section Archelirion resulted in the oriental hybrids, whereas Liliumlongiflorum belongs to the section Leucolirion. Crosses between L. longiflorum and 'Asiatic' lilies lead to development of 'LA' hybrids while crosses between L. longiflorum and 'Oriental' produced the 'LO' hybrids, specially the difficult hybridisation between Asiatic hybrids and Oriental hybrids ('OA' hybrids), a combination of the two most commercially important lily clusters, are a break-through in lily breeding and hybridisation. Lily is the common English name for flowering plants of the Asiatic lily genus and they are extensively being grown in polyhouse as cut flower in global flower trade because there is a greater variety of growth seasons, a vast range of colours, and enduring quality.

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In recent years, it was found that growth regulators play an important role in regulating the flower production in gladiolus to catch the early and late demands in the cut flower market **(Bhattacharjee*et al.*, 2006)**[1].The major areas where plant growth promoters are used in floriculture are plant propagation, plant height control, regulation of flowering, and prolonging the life of cut blooms, besides some other minoruses. GA3 enhance the vase life of flowers also there are widespread applications of GA3 for the promotion of growth in a variety of horticultural crops.Research work on the use of traditional plant growth promoters like gibberellins, improving bulb and corm multiplication rate as well as bulb and corm enlargement was carried out in different parts of the country **(Kumar *et al.*,2002)**[2]**.**Gibberellins can play a great role in regulation of bulb production and breaking dormancy of bulb.But artificial application of plant growth regulators can also enhance, hasten, or delay the flowering time in some plant species. Other publications claim that gibberellins cause early flowering and extend floral life. Growth and yield was enhanced by application of GA3 **(Umrao*et al.*, 2007)**[3]**.**

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2. MATERIALS AND METHODS

2.1 Experimental location, environmental conditions (climate and weather)

A field experiment was carried out under the present investigation entitled "Effect of Plant Growth Regulators on Growth and Flower Yield of Lilum (*Liliumlongiflorum L.) cv. Eremo*Under Polyhouse in Prayagraj Agro Climatic Condition.", which needed different materials and methodologies for various operating studies to be made in the field and the laboratory.

The present investigation was carried out in the form of field experiment in Horticultural Research Field, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India during 2021-2022. The area comes under sub-tropical zone of Indo-Gangetic plains. Geographically, Prayagraj is situated at 250 24' 42" N latitude, 810 50' 56" E longitude and 98 m altitude above the mean sea level. Climate in this sub-tropical, south-eastern part of Uttar Pradesh prevails with both the extremes of temperature. In winter, during December and January temperatures sometime fall very low up to 3°C, while the weather becomes very hot in summer with the temperatures sometimes soaring to a high of over 47°C in May and June. In winter, cold wave and during the summer, hot desiccating winds are also not uncommon in the region.

2.2 Biologic material

Bulb of Lilium Hybrid for the experiment were procured from Bhola nursery, Lucknow.

2.3 The experimental design and parameters determined

2.3.1 Experimental design

The trail was laid out in Randomized block design (RBD) with 13 treatments which have been replicated 3 times. 13 Treatments were used.

2.3.2 Growth Parameters

In order to understand the growth & development of the crop. Growth parameters measured in term plant height(cm), plant spread(cm^2), number of leaves per plant at 20,40 and 60 days after transplanting.

2.3.3 Flowering parameters

Days to flower bud initiation, number of days to first flower,Flower stalk diameter, number of flower buds inflorescence,Flower bud length, Bud diameter, Flower diameter, vase life.

2.3.4 Yield parameters

Number of flower spike per plant, Number of flower spike per hectare.

2.4 Statistical analysis

The results and data were subjected to statistical analysis separately by using analysis of variance technique (ANOVA). The difference among treatments means was compared by using least significant difference test at 5% probability levels.

3. RESULTS AND DISCUSSION

3.1 Growth Parameter

Growth parameters data are shown in Table 1.Significant difference was observed due to different plant growth regulators for plant height, at 60 DAT. The Maximum Plant height at 60 days (71.36 cm) was recorded in the T_{10} (GA3@200ppm), followed by T_8 (Ethrel@550ppm) with (68.41 cm) and the minimum Plant Height at 60 days (56.10 cm) was recorded in T_0 (Control@ water spray). Similar findings were found by **Pahare et al., (2020)[4].**

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Significant difference was observed due to different plant growth regulators for number of leaves per plant, at 60 DAT. The Maximum number of leaves per plant at 60 days (72.36) was recorded in the T_{10} (GA3@200ppm), followed by T_8 (Ethrel@550ppm) with (70.41) and the minimum number of leaves per plant at 60 days (50.10) was recorded in T_0 (Control@ water spray). Similar results were obtained by **Dahal et al. (2014)[5].**

Significant difference was observed due to different plant growth regulators for plant spread (cm^2), at 60 DAT. The Maximum plant spread (cm^2)at 60 days (15.44 cm^2) was recorded in the T_{10} (GA3@200ppm), followed by T_8 (Ethrel@550ppm) with (14.50 cm^2) and the minimum plant spread (cm^2)at 60 days (11.30 cm^2) was recorded in T_0 (Control@ water spray). Similar results were reported by **Pahare*et al.,* (2020)** found that foliar application thrice a week recorded extreme plant spread.

3.2 Flowering parameters

Significant difference was observed due to different plant growth regulators for days of first bud initiation. The minimum days of first bud initiation(44.33 days) was recorded in the T_{10} (GA_3@200ppm), followed by T_8 (Ethrel@550ppm) with (45.33 days) and the Maximum days of first bud initiation(53.66 days) was recorded in T_0 (Control@water spray) **Kumar R *et al.,* (2012)[6].**

Significant difference was observed due to different plant growth regulators for days of first flower initiation. The minimum days of first bud initiation(50.07 days) was recorded in the T_{10} (GA_3@200ppm), followed by T_8 (Ethrel@550ppm) with (51.59 days) and the Maximum days of first flower initiation(62.47 days) was recorded in T_0 (Control@water spray).

Significant difference was observed due to different plant growth regulators for flower stalk diameter. The Maximum flower stalk diameter (6.55 mm) was recorded in the T_{10} (GA_3@200ppm), followed by T_8 (Ethrel@550ppm) with (6.32 mm) and the minimum flower stalk diameter(5.21 mm) was recorded in T_0 (Control@water spray)**Kuldeep S et al., (2018)[7].**

Significant difference was observed due to different plant growth regulators for number of buds per inflorescence. The Maximum number of buds per inflorescence (4.66) was recorded in the T_{10} (GA_3@200ppm), followed by T_8 (Ethrel@550ppm) with (4.44) and the minimum number of buds per inflorescence (2.96) was recorded in T_0 (Control@ water spray).

Significant difference was observed due to different plant growth regulators for bud length. The Maximum number of buds per inflorescence (11.59 cm) was recorded in the T_{10} (GA_3@200ppm), followed by T_8 (Ethrel@550ppm) with (10.33 cm) and the bud length (7.18 cm) was recorded in T_0 (Control@ water spray).

Significant difference was observed due to different plant growth regulators for bud diameter. The Maximum bud diameter (17.07 mm) was recorded in the T_{10} (GA_3@200ppm), followed by T_8 (Ethrel@550ppm) with (15.91 mm) and the bud diameter (11.30 mm) was recorded in T_0 (Control@ water spray). **Kumaret al., (2011)[8].**

Significant difference was observed due to different plant growth regulators for flower diameter. The Maximum flower diameter (16.26 cm) was recorded in the T_{10} (GA_3@200ppm), followed by T_8 (Ethrel@550ppm) with (15.70 cm) and the flower diameter (9.67 cm) was recorded in T_0 (Control@ water spray) **Nowak et al., (1985)[9].**

Significant difference was observed due to different plant growth regulators for vase life (days). The Maximum vase life(10.55 days) was recorded in the T_{10} (GA_3@200ppm), followed by T_8 (Ethrel@550ppm) with (9.77 days) and the vase life (6.55 days) was recorded in T_0 (Control@ water spray) **Sable*et al.* (2015)[10].**

Significant difference was observed due to different plant growth regulators for number of spike yield per plant. The Maximum number of spike yield per plant (2.23) was recorded in the T_{10} (GA_3@200ppm), followed by T_8 (Ethrel@550ppm) with (2.08) and the number of spike yield per plant (1.12) was recorded in T_0 (Control@ water spray).

Significant difference was observed due to different plant growth regulators for number of spike yield per hectare. The Maximum number of spike yield per hectare (77142.59) was recorded in the T_{10} (GA_3@200ppm), followed by T_8 (Ethrel@550ppm) with (76883.23) and theMinimum number of spike yield per hectare (73883.93) was recorded in T_0 (Control@ water spray).

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Table 1.Effect of growth regulators on on plant height and no. of leaves and plant spread (cm^2)

Treatment symbol	Treatment	Plant height			No. Of Leaves			Plant spread		
		20DAP	40DAP	60DAP	20DAP	40DAP	60DAP	20DAP	40DAP	60DAP
T_0	Control@water spray	22.13	35.89	56.10	26.13	41.89	50.10	6.22	8.74	11.30
T_1	IAA@25ppm	30.77	46.04	60.10	29.47	56.27	63.50	7.81	10.37	14.19
T_2	IAA@50ppm	31.13	45.96	60.25	27.77	52.42	59.65	7.73	10.71	14.11
T_3	IAA@75ppm	30.63	45.66	61.62	32.67	56.33	68.57	8.52	10.56	13.66
T_4	IAA@100ppm	27.73	42.31	59.65	31.27	44.73	51.97	7.41	9.81	14.18
T_5	Ethrel@150ppm	31.10	41.66	60.56	30.67	48.20	55.43	6.99	10.88	13.81
T_6	Ethrel@300ppm	31.23	49.86	61.80	29.33	57.73	64.97	8.77	10.37	14.52
T_7	Ethrel@450ppm	31.20	40.95	58.10	32.47	54.39	61.62	7.59	10.96	13.67
T_8	Ethrel@550ppm	32.33	50.07	68.41	33.33	60.07	70.41	9.10	11.70	14.50
T_9	GA3@100ppm	31.10	47.01	58.31	31.10	47.01	58.31	7.56	10.85	14.11
T_{10}	GA3@200ppm	33.43	55.55	71.36	38.43	64.55	72.36	9.46	12.44	15.44
T_{11}	GA3@300ppm	29.27	46.48	59.03	29.27	46.48	59.03	8.44	10.74	14.13
T12	GA3@500ppm	30.70	47.53	58.23	30.70	47.53	58.23	8.27	10.70	13.30
	F-Test	S	S	S	S	S	S	S	S	S
	SED(≠)	1.31	2.60	1.88	1.34	2.12	1.56	0.43	0.48	0.64
	CD@5%	2.66	5.27	3.80	2.66	5.27	3.80	0.87	0.97	1.29
	CV	5.34	6.97	3.77	5.34	6.97	3.77	6.60	5.54	5.64

Table. 2 Flowering parameters performance of different treatments in Lilium

Treatment symbol	Treatment	Bud initiation (days)	Flower initiation (days)	Flower stalk diameter (cm)	Number of buds per inflorescence
T_0	Control@water spray	53.66	62.47	5.21	2.96
T_1	IAA@25ppm	49	53.32	6.07	3.96
T_2	IAA@50ppm	48.33	56.4	5.8	3.7
T_3	IAA@75ppm	48.67	58.33	6.13	3.83
T_4	IAA@100ppm	50	58.02	5.81	4.21
T_5	Ethrel@150ppm	46	56.44	5.76	4.07
T_6	Ethrel@300ppm	48	59.14	6.04	3.4
T_7	Ethrel@450ppm	46.66	60.26	5.76	3.84
T_8	Ethrel@550ppm	45.33	51.59	6.32	4.44
T_9	GA3@100ppm	47.33	56.5	5.84	3.58
T_{10}	GA3@200ppm	44.33	50.07	6.55	4.66
T_{11}	GA3@300ppm	47.66	54.29	6.14	4.1
T12	GA3@500ppm	46.66	54.14	5.88	4.21
F-TEST		S	S	S	S
SEd		1.65	1.54	0.3	0.35
CD (5%)		3.35	3.11	0.61	0.72
CV%		4.24	3.35	6.29	11.18

Table: 3 Effect of growth regulators on flower yield attributes

Treatment symbol	Treatment	Bud length (cm)	Bud diameter (mm)	Flower diameter (cm)	Vase life (Days)
T_0	Control@water spray	7.18	11.3	9.67	6.55
T_1	IAA@25ppm	8.45	14.44	14.7	8
T_2	IAA@50ppm	8.24	15.06	14.29	7.66
T_3	IAA@75ppm	8.03	15.7	13.85	8.22
T_4	IAA@100ppm	9.11	13.89	13.96	8.66
T_5	Ethrel@150ppm	9.03	14.54	14.74	8.55
T_6	Ethrel@300ppm	8.44	14.73	12.55	8.22
T_7	Ethrel@450ppm	9.07	14.18	11.88	8.44
T_8	Ethrel@550ppm	10.33	15.91	15.7	9.77
T_9	GA3@100ppm	9.67	14.29	13.88	8.66
T_{10}	GA3@200ppm	11.59	17.07	16.26	10.55
T_{11}	GA3@300ppm	9.56	15.44	14.52	9.03
T12	GA3@500ppm	10.07	15.63	15.26	9.13
F-TEST		S	S	S	S
SEd		0.16	0.65	0.6	0.37
CD (5%)		0.33	1.31	1.22	0.75
CV%		2.24	5.39	5.33	5.32

Table: 4 flower Yield parameters on different treatments in Lilium

Treatment symbol	Treatment	Number of flower spike per plant	Number of flower spike per hectare
T_0	Control@water spray	1.12	73883.93
T_1	IAA@25ppm	1.71	76176.34
T_2	IAA@50ppm	2.05	75634.23
T_3	IAA@75ppm	2.04	73735.77
T_4	IAA@100ppm	1.73	75513.3
T_5	Ethrel@150ppm	1.96	75255.23
T_6	Ethrel@300ppm	1.36	76764.74
T_7	Ethrel@450ppm	1.41	75585.67
T_8	Ethrel@550ppm	2.08	76883.23
T_9	GA3@100ppm	1.25	74022.22
T_{10}	GA3@200ppm	2.23	77142.59
T_{11}	GA3@300ppm	1.92	75810.74
T12	GA3@500ppm	1.71	75985.95
F-TEST		S	S
SEd		0.29	669.6

CD (5%)	0.6	1354.38
CV%	21.09	1.08

4. Conclusion

In the present investigation it is concluded that the treatment (T_{10}) (GA3@200ppm)was found to be the best in terms of plantheight (71.36 cm), number of leaves per plant(72.36),plant spread (15.44 cm^2),days of first bud initiation(50.07 days), flower stalk diameter(6.55 mm), bud length (11.59 cm),flower diameter (16.26 cm), number of buds per inflorescence(4.66), bud diameter(17.07 mm), vase life(10.55 days), spike yield per plant (2.23), spike yield per hectare (77142.59) of lilium.

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