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Effect of bio-regulators on vegetative parameters of Asiatic lily var Pavia under protected condition

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Abstract
An investigation on "Effect of bio-regulators on vegetative parameters of Asiatic lily var. Pavia under protected condition" was carried out at Department of Floriculture and Landscape Architecture, College of Horticulture, Mudigere (Under University of Agricultural and Horticultural sciences, Shivamogga), during 2018-19. The treatments comprised of, GA_3 (100, 150 and 200 ppm), BA (150, 300 and 450 ppm), NAA (100,150 and 200 ppm) and CCC (1000, 1500 and 2000 ppm) and control. The results revealed that GA_3 @ 200 ppm recorded minimum days to sprouting (3.33), maximum plant height (98.44 cm), number of leaves (80.93), leaf length (12.53 cm), leaf breadth (2.77 cm), leaf area (1704.60 cm^2) and leaf area index (LAI) (5.68). The maximum number of days for sprouting (16.67), minimum plant height (21.93 cm), minimum number of leaves (31.77), minimum length of leaves (4.27 cm), breadth of leaves (1.37 cm), minimum leaf area (442.45 cm^2) and minimum LAI (1.47) was recorded by BA @ 450 ppm. NAA @ 100 ppm recorded maximum chlorophyll-a, chlorophyll-b and total chlorophyll content (98, 0.50 and 1.48 mg per g fresh weight, respectively). Whereas BA @ 450 ppm was recorded minimum chlorophyll-a, chlorophyll-b and total chlorophyll content (0.63, 0.22 and 0.85 mg per g fresh weight, respectively).

Keywords: vegetative, Asiatic, condition, floriculture, sciences, Shivamogga, chlorophyll

Introduction

India is one of the major cut flowers producing country in the world, further Asiatic lily is one of the most beautiful and fascinating cut flowers grown all over the world. It is by far, the best-suited cut flower plant for the tropical and sub-tropical regions of India. Lilies are one of the incredible flowering plants which are necessary in culture and literature of the world. Elegant, glamorous and extremely beautiful, Asiatic lilies are one of the easiest plants to grow. The horticulturists highly appreciate the cultivars of genus *Lilium* for their outstanding range of colors, fragrance and a days after planting ability to several environmental conditions. Asiatic lilies are true lilies from the genus *Lilium* and the family Liliaceae.

The lilies are cultivated all over the world due to its size, beauty, and longevity. China alone dominates the growing area for cut lilies, with over 8,000 ha in 2015, Kenya and Japan have grown around 1,000 ha each. Approximately an area of 6,400 ha was used to produce lily bulbs in Netherland in 2018 (Anon., 2019) [2]. The exports of cut lily were dominated by the Netherlands, and of imports by the UK. In 2016, the Netherlands exported lilies worth €112m. *Lilium* is grown in India with a production of 8000 number per tons of cut flowers (Hanks, 2018) [17].

The bio-regulators play an important role and are being used for the production of quality cut flowers and bulbs in Asiatic lily (Manimaran *et al.*, 2017) [13]. The bio-regulators are the organic chemical compounds which modify or regulate the physiological process in an appreciable measure in plants when used in small concentrations. They are readily absorbed and move rapidly through tissues when applied to different parts of the plant (Dutta and Ramadas, 1998) [4]. The bio-regulators have been widely used in many ornamental crops and flower crops *viz.*, gibberellic acid, NAA, cycocel and benzyl adenine have been reported to be remarkably successful in quality bloom production and gaining momentum (Sanap *et al.*, 2000) [18].

The gibberellins are a rather diverse group of plant substances that enhance any physiological or biochemical process in plants. The use of GA_3 for boosting the growth and vigor of various horticultural plants is very old and well documented (Gul *et al*., 2006) [9]. The auxins have an essential role in the coordination of many growths and behavioural process in the plant's life cycle. These are the chemicals synthesized by chemists that cause various physiological actions similar to IAA. The NAA influences the metabolic process and cell division. It induces flowering, reduces flower drop, increases fruit set and delays senescence (Chopde *et al*., 2012) [3].

Materials and Methods

The experiment was conducted at Department of Floriculture and Landscape Architecture, College of Horticulture, Mudigere (Under University of Agricultural and Horticultural sciences, Shivamogga), during 2018-19.

The experiment was laid out in the Randomized Complete Block Design (RCBD) with 13 treatment and three replications. It is comprising of different growth regulators *viz*., GA_3 (100, 150 and 200 ppm), BA (150, 300 and 450 ppm), NAA (100, 150 and 200 ppm) and CCC (1000, 1500 and 2000 ppm) with control.

The medium sized bulbs were soaked for 12 hours in different growth regulators solution and in water as per the treatment schedule. The bulbs were planted at 20 cm × 15 cm spacing in unit plot of 2 m × 1 m. The crop was fertilized with 30 g per m^2 of calcium nitrate, 20 g per m^2 of urea, 20 g per m^2 of MOP and 20 g per m^2 of DAP. Intercultural operations like weeding, earthing up and watering were done as and when necessary. The observations were recorded with respect to growth parameters at 15, 30, 45 and 60 days after planting to know the response of Asiatic lily to different bio-regulators at different concentration.

Results and Discussion

The results presented in Table 1 revealed that bio-regulators treatments had significantly varied the days taken for sprouting. The minimum number of days taken for sprouting (3.33) was recorded by the treatment GA_3 @ 200 ppm. The maximum number of days for sprouting (16.67) was taken by BA @ 450 ppm (Fig. 1). This might be due to free GA_3, which is active in breaking down the reserve food material by hydrolytic enzymes in the presence of enough moisture which resulted in early sprouting and ethylene production might be the reason for the growth of dormant bulbs, which leads to early sprouting of bulbs. The similar findings were reported by Manasa *et al.* (2017) [12], Priyanka *et al*. (2018) [13] in gladiolus, Wagh *et al.* (2012) [19] in tuberose.

The plant height varied significantly among the treatments the treatment GA_3 @ 200 ppm recorded maximum plant height (98.44 cm). Whereas, the minimum plant height (21.93 cm) was observed in the treatment BA @ 450 ppm. The GA_3 increased the height of the plant which may be due to the growth promotion effect of GA_3 in stimulating and accelerating cell division, increasing cell elongation and enlargement or both (Hartmann *et al*., 1990) [8]. Similar findings were earlier reported by Acharjee *et al.* (2015) [1] in oriental lilium, Manasa *et al.* (2017) [12], Priyanka *et al*. (2018) [13] in gladiolus and Kumar *et al.* (2013) [10] in tulip.

The maximum number of leaves per plant (80.93) was noticed by the bulbs treated with GA_3 @ 200 ppm and the minimum number of leaves (31.77) was observed in bulbs treated with BA @ 450 ppm. The maximum length of leaves (12.53 cm) and breadth (2.77 cm) was observed in GA_3 @ 200 ppm, whereas the minimum length of leaves (4.27 cm) and breadth of leaves (1.37 cm) was recorded in BA @ 450 ppm. This might be due to the gibberellic acid, which increases cell division and cell elongation, which might have resulted in more number of cells and increase in cell length, which ultimately effects on number of leaves, length and breadth of leaves. These results are in conformity with the findings of Acharjee *et al.* (2015) [1] in oriental lilium, Rani and Singh (2013) [11] in tuberose and Rana *et al.* (2005) [16] in gladiolus.

Table 1: Effect of different bio-regulators on vegetative parameters of Asiatic lily var. Pavia under protected condition

Treatments	Days taken for sprouting	Plant height (cm)	Number of leaves	Leaf length (cm)	Leaf breadth (cm)
T_1 – Control	8.00	76.56	61.73	9.37	1.96
T_2 - GA_3 @ 100 ppm	6.00	88.14	67.27	10.59	2.27
T_3 - GA_3 @ 150 ppm	4.67	91.83	72.33	11.80	2.43
T_4 - GA_3 @ 200 ppm	3.33	98.44	80.93	12.53	2.77
T_5 - BA @150 ppm	12.67	46.35	56.40	7.28	1.83
T_6 - BA @ 300 ppm	14.00	32.93	40.27	5.73	1.61
T_7 - BA @ 450 ppm	16.67	21.93	31.77	4.27	1.37
T_8 - NAA @ 100 ppm	6.00	87.63	68.67	11.33	2.45
T_9 - NAA @ 150 ppm	6.33	81.37	62.13	10.35	2.24
T_{10} - NAA @ 200 ppm	7.33	74.27	56.20	9.67	2.01
T_{11} - CCC @ 1000 ppm	7.00	73.77	55.07	9.54	2.07
T_{12} - CCC @ 1500 ppm	9.00	68.20	52.07	8.61	1.93
T_{13} - CCC @ 2000 ppm	9.67	63.57	45.77	8.03	1.67
S. Em±	0.67	2.09	1.99	0.43	0.16
C.D @ 5%	1.95	6.11	5.83	1.26	0.49

Table 2: Effect of different bio-regulators on vegetative parameters of Asiatic lily var. Pavia under protected condition

Treatments	Leaf area (cm^2)	Leaf Area Index (LAI)	Chlorophyll-a (mg/g of fresh wt.)	Chlorophyll-b (mg/g of fresh wt.)	Total chlorophyll (mg/g of fresh wt.)
T_1 - Control	1096.55	3.66	0.62	0.53	1.15
T_2 - GA_3 @ 100 ppm	1558.24	5.19	0.97	0.48	1.45
T_3 - GA_3 @ 150 ppm	1608.12	5.36	0.95	0.45	1.40
T_4 - GA_3 @ 200 ppm	1704.60	5.68	0.81	0.35	1.16
T_5 - BA @150 ppm	764.55	2.55	0.76	0.38	1.14
T_6 - BA @ 300 ppm	492.31	1.64	0.66	0.26	0.92
T_7 - BA @ 450 ppm	442.45	1.47	0.63	0.22	0.85
T_8 - NAA @ 100 ppm	1578.03	5.26	0.98	0.50	1.48
T_9 - NAA @ 150 ppm	1321.33	4.40	0.91	0.33	1.24
T_{10} - NAA @ 200 ppm	1104.94	3.68	0.84	0.33	1.17
T_{11} - CCC @ 1000 ppm	1256.23	4.19	0.97	0.45	1.42
T_{12} - CCC @ 1500 ppm	1137.18	3.79	0.92	0.42	1.34
T_{13} - CCC @ 2000 ppm	829.12	2.76	0.90	0.33	1.23
S. Em±	273.53	0.91	0.081	0.072	0.11

C.D @ 5%	798.41	2.66	0.23	0.21	0.34

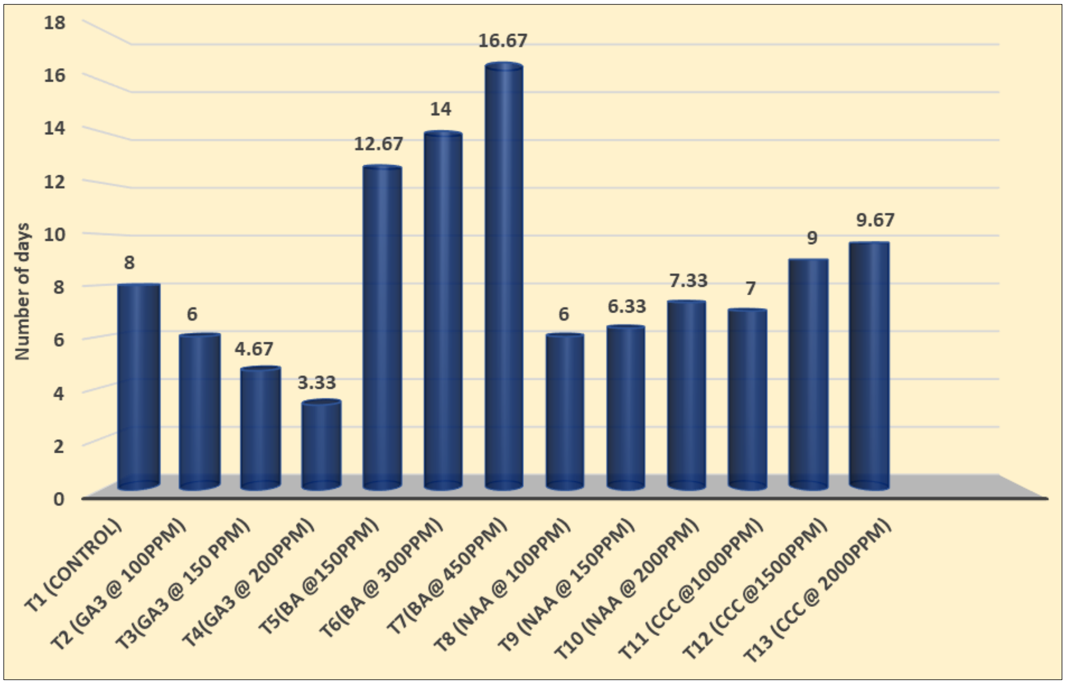

Fig 1: Effect of bio-regulators on days taken for sprouting of bulbs Asiatic lily var. Pavia under protected condition

The bio-regulators showed significant differences with respect to leaf area and leaf area index (LAI) (Table 2). The maximum leaf area (1704.60 cm^2) was observed in treatment GA_3 @ 200 ppm and minimum leaf area was recorded from BA @ 450 ppm (442.45 cm^2). The maximum leaf area index (LAI) (5.68) was observed in treatment GA_3 @ 200 ppm and minimum LAI was recorded from BA @ 450 ppm (1.47). This might be due to the active growth of Asiatic lily, which is encouraged by gibberellic acid. These results are correlated with the results of Kumar *et al.* (2010) [10], Patel *et al*. (2013) [14], Manasa *et al.* (2017) [12] and Priyanka *et al*. (2018) [13] in gladiolus.

All the treatments showed significant differences with respect to leaf chlorophyll content. Since, plant bio-regulators could delay the degradation of chlorophyll by possibly delaying the breakdown of protein used in the synthesis of chlorophyll (Hafman, 1988) [6]. The NAA @ 100 ppm recorded maximum chlorophyll-a, chlorophyll-b and total chlorophyll content (98, 0.50 and 1.48 mg per g fresh weight, respectively). Whereas BA @ 450 ppm was recorded minimum chlorophyll-a, chlorophyll-b and total chlorophyll content (0.63, 0.22 and 0.85 mg per g fresh weight, respectively). The maximum chlorophyll content from NAA treatment might be due to the slow rate of chlorophyll degradation by possibly delaying the breakdown of protein. These results are conformity with earlier findings of Emami *et al*. (2011) [5] in lily.

Conclusion

The study revealed that among different bio-regulators GA_3 @ 200 ppm showed better vegetative parameters like minimum days to sprouting, maximum plant height, number of leaves, leaf length, leaf breadth, leaf area and leaf area index (LAI). NAA @ 100 ppm recorded maximum chlorophyll content.

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