Potential role of bio-stimulants in administering floral characters of Asiatic lily cv. Indian Summerset

ABSTRACT

An experiment on "Potential role of of bio-stimulants in administering floral characters of Asiatic lily cv. Indian Summerset" was conducted at Horticulture Research Farm, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology And Sciences, Prayagraj during 2021-22 and 2022-23. The experiment consisted of thirteen treatments *viz* T_1-control, T_2- 10 ppm triacontanol, T_3-15 ppm triacontanol, T_4-20 ppm triacontanol, T_5- 25 ppm triacontanol, T_6- 5 ppm brassinolide, T_7-10 ppm brassinolide, T_8-15 ppm brassinolide, T_9-20 ppm brassinolide, T_{10}-100 ppm nitrobenzene, T_{11}- 200 ppm nitrobenzene, T_{12}-300 ppm nitrobenzene, T_{13}- 400 ppm nitrobenzene which were arranged in Randomized block design with three replications. Foliar application of bio-stimulants were sprayed twice at fifteen days interval. Analysis of the data indicated that T_9 -brassinolide @ 20 ppm reported to be best for parameters namely days taken for opening of first flower from bud emergence (38.6 days), pedicel length (8.2 cm), number of flowers per stalk (3.1), flower length (12.4cm), flower diameter (14.7 cm) and flower yield (7.8 flowers/plot and 33.3 flowers/m^2).

Keywords: Asiatic lily, flower, bio-stimulants, triacontanol, brassinolide, nitrobenzene.

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Introduction

Cut flower production has indeed become a lucrative sector in horticulture, and among the various flowers cultivated, lilies stand out as one of the most significant cut flower. Belonging to the family Liliaceae, which comprises over 100 species, lilies are celebrated for their enchanting beauty, delicate fragrance, and longstanding cultural significance. With advancements in cultivation techniques and the development of new varieties, lily production has seen substantial growth. Asiatic lilies, in particular, have gained immense popularity, becoming iconic symbol in floriculture. Lilies encompass several important groups such as Asiatic, longiflorum, Oriental, Trumpet, and their hybrids, originating predominantly from Asia (Tuyl *et al.*, 1996). Their natural habitat spans various regions in the Northern Plains, including North America, Asia, and Europe, with a wide distribution ranging from the Arctic Circle to the Philippine Islands and Southern India (Klasman *et al.,* 2002). The cultivation of Asiatic lily is greatly enhanced by the strategic application of biostimulants, which play a crucial role in optimizing growth, flowering, and overall productivity of this iconic flower. Bio-stimulants are derived from natural or synthetic sources and can be administered to different plant parts. They trigger modifications in essential and structural plant processes, ultimately enhancing plant growth by bolstering resilience to environmental stress and enhancing the yield and quality of horticultural crops. Triacontanol are plant growth-promoting element that enhances the growth of plants when used exogenously at low concentration in most of the plants (Naeem *et al.*, 2012). Brassinolide has effectively helped in improving the production under stressful condition (Lalarukh *et al.,* 2022). Nitrobenzene is a compound characterized by its pale-yellow, oily appearance and almond-like fragrance. Nitrobenzene has been observed to have positive effects on flowering crops, particularly in enhancing their flowering attributes. Application of nitrobenzene has resulted in improved flower production and quality in numerous plant species.

Materials and Methods

The present investigation entitled "Potential role of bio-stimulants in administering floral characters of Asiatic lily cv. Indian summerset" was carried out during 2021-22 and 2022-23 at Horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Naini, Prayagraj. The experiment was laid out with thirteen treatments which were replicated thrice. The treatments were T_1- Control, T_2- 10 ppm Triacontanol, T_3-15 ppm Triacontanol, T_4-20 ppm Triacontanol, T_5- 25 ppm Triacontanol, T_6- 5 ppm Brassinolide, T_7-10 ppm Brassinolide, T_8-15 ppm Brassinolide, T_9-20 ppm Brassinolide, T_{10}-100 ppm Nitrobenzene, T_{11}-200 ppm Nitrobenzene, T_{12}-300 ppm Nitrobenzene, T_{13}- 400 ppm Nitrobenzene. Application of bio-stimulants was done two times through foliar spray the first spray was done fifteen days after planting.

Results and discussion

Days taken for first flower opening from bud emergence

Significantly lesser number of days taken for first flower opening from bud emergence (33.2 days) which was reported in T_9 (brassinolide at the rate of 20 ppm) followed by T_8 (brassinolide at the rate of 15 ppm, 35.4 days) while T_1 (control) reported significantly more number days (41.9 days). The early onset of flowering, starting from bud emergence, can be attributed to the signalling transduction of brassinolide and the interaction of genes involved in brassinolide biosynthesis. When brassinolide is applied, it accelerates the timing of circadian rhythms, which in turn influences the flowering time of plants. The expression of CPD gene (CONSTITUTIVE PHOTOMORPHOGENESIS AND DWARFISM) is responsible for exhibiting circadian and diurnal rhythmicity (Bancos *et al.*, 2006). The results are in conformity with the study performed by Amira *et al.*, 2022 in prickly pear and Raja *et al.*, 2020 in Jatropha.

Pedicel length

Longer pedicel (9.1cm) were reported in T_9 (brassinolide at the rate of 20 ppm) which was followed by T_8 (brassinolide at the rate of 15ppm, 8.6 cm) while T_1 (control) reported significantly shorter pedicel (5.8 cm). Elongation in pedicel may be attributed to the fact that brassinolide positively influence the cell division along with cell elongation, and splitting of internode, this phenomenon is called brassin activity. The distribution of brassinolide plays an important part in flower organ formation (Li and He, 2013). Brassinolide plays crucial role in regulation of reproductive plant part (Kang *et al.*, 2011). The results are in conformity with the findings of Xia *et al.* (2009) in cucumber and Prakash *et al.* (2008) in sesame.

No. of flowers per stalk

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More number of flowers per stalk (4.0) were reported in T_9 (brassinolide at the rate of 20 ppm) which was followed by T_8 (brassinolide at the rate of 15 ppm, 3.5) while T_1 (control) reported significantly lesser number of flowers per stalk (2.8). More number of flowers per stalk may be attributed to the positive effect of brassinolide treated plants empowering production of more photosynthates which resulted in the presence of more assimilates to shoot apex at the time of the commencement of the floral primordial (Lakshmi *et al.*, 2021). Brassinolide is also known to positively enhance the growth of reproductive part which may have eventually lead to positive influence on formation of higher number of buds (Vogler *et al.*, 2014). Brassinolide application might have helped in increasing the number of flowers in rose (Alvarez *et al.*, 2005). Brassinolide spray positively influence the number of flowers/spikes in gladiolus (Mollaei *et al.,* 2018). These results are in conformity with the findings of obtained from the study of Padmalatha *et al.* (2013) in gladiolus Aklade *et al.* (2009) in chrysanthemum and Alvarez *et al.* (2005) in rose.

Flower length

Longer flower (15.0 cm) were reported in T_9 (brassinolide at the rate of 20 ppm) which was followed by T_8 (brassinolide at the rate of 15ppm, 13.4 cm) while T_1 (control) reported significantly shorter flower (10.3 cm). The increased flower length may be due to the effect of brassinolide enhancing cell division and cell elongation in the intercalary meristem. Brassinolide enhances the vegetative development and boost photosynthetic and metabolic activities, which may have resulted in greater translocation and consumption of photosynthetic products resulting in the elongation of the petals (Mollaei *et al.,* 2018). These results are in conformity with the finding done by Babu *et al.* (2009) in jatropha.

Flower diameter

Larger flower (16.4 cm) were reported in T_9 (brassinolide at the rate of 20 ppm) which was followed by T_8 (brassinolide at the rate of 15ppm, 15.7 cm) while T_1 (control) reported significantly smaller flower (10.2 cm). The use of brassinolide led to an increase in flower diameter as brassinolide contributes to cell elongation, leading to an increase in the bloom's size. Another possibility is translocation of photosynthates leading to increase in the diameter of the flower intensifying the effect of sink. These results are in conformity with the study done by Xia *et al.* (2009) in cucumber.

No. of flower stalks /plot

Significantly more number of flower stalks /plot (9.0) were reported in T_9 (brassinolide at the rate of 20 ppm) which was found to be at par with T_4 (triacontanol at the rate of 20 ppm, 8.6), T_5 (triacontanol at the rate of 25 ppm, 8.6), T_8 (brassinolide at the rate of 15 ppm, 8.6), T_{11} (nitrobenzene at the rate of 200 ppm, 8.6), T_{13}(nitrobenzene at the rate of 400 ppm, 8.6), T_{12} (nitrobenzene at the rate of 300 ppm, 8.3), T_6 (brassinolide at the rate of 5 ppm, 8.3), T_7 (brassinolide at the rate of 10 ppm, 8.3) while T_1 (control, reported significantly lesser number of flower stalks /plot (7.1).

No. of flower stalks/m^2

Significantly more number of flower stalks/m^2 (33.3) were reported in T_9 (brassinolide at the rate of 20 ppm) which was found to be at par with T_5 (triacontanol at the rate of 25 ppm, 32.6), T_{13}(nitrobenzene at the rate of 400 ppm, 32.6), T_8 (brassinolide at the rate of 15 ppm, 32.0), T_{11} (nitrobenzene at the rate of 200 ppm, 32.0), T_7 (brassinolide at the rate of 10 ppm, 31.4), T_{12} (nitrobenzene at the rate of 300 ppm, 31.4), T_6 (brassinolide at the rate of 5 ppm, 30.8), T_3 (triacontanol at the rate of 15 ppm, 30.2) while T_1 (control) reported significantly lesser number of flowers/m^2 (26.5). More number of flowers may be attributed to the positive effect of brassinolide treated plants which resulted in the presence of more assimilates to shoot apex at the time of the commencement of the floral primordial (Lakshmi *et al.*, 2021). Brassinolide is also known to Positively enhance the growth of reproductive part which may have eventually lead to positive influence on formation of higher number of buds (Vogler *et al.*, 2014). Brassinolide spray positively influence the number of flowers/spikes in gladiolus (Mollaei *et al.*, 2018). These results are in conformity with result obtained from the study of Padmalatha *et al.* (2013) in gladiolus and Alvarez *et al.* (2005) in rose.

Conclusion

The results have shown that T_9 - brassinolide at the rate of 20 ppm had most significant effect in respect to days taken for opening of first flower from bud emergence, pedicel length, number of flowers per stalk, flower length, flower diameter and flower yield.

Table No. 1 Response of bio-stimulants in Days taken for opening of first flower from bud emergence and Pedicel length Asiatic lily plants

	Days taken for opening of first flower from bud emergence			**Pedicel length**		
	2021-22	**2022-2023**	**Pooled data**	**2021-22**	**2022-2023**	**Pooled data**
Treatment	42.0	41.8	41.9	6.2	5.4	5.8
T_1- Control	41.5	41.7	41.6	7.2	7.4	7.3
T_2- 10 ppm Triacontanol	39.6	42.8	41.2	7.5	7.7	7.6
T_3-15 ppm Triacontanol	35.7	40.5	38.1	7.6	7.9	7.7
T_4-20 ppm Triacontanol	39.8	36.5	38.1	8.2	8.5	8.4
T_5- 25 ppm Triacontanol	41.1	36.3	38.7	8.0	8.4	8.2
T_6- 5 ppm Brassinolide	42.3	38.0	40.1	8.1	8.4	8.2
T_7-10 ppm Brassinolide	34.5	36.4	35.4	8.4	8.8	8.6
T_8-15 ppm Brassinolide	33.7	32.7	33.2	9.1	9.4	9.2
T_9-20 ppm Brassinolide	36.3	39.5	38.6	7.7	8.4	8.2
T_{10}-100 ppm Nitrobenzene	36.7	37.8	37.8	7.8	7.9	7.9
T_{11}- 200 ppm Nitrobenzene	37.7	36.2	37.7	7.9	8.0	7.9
T_{12}-300 ppm Nitrobenzene	35.3	38.8	37.9	8.1	8.4	8.4

T_{13}- 400 ppm Nitrobenzene	**S**	**S**	**S**	**S**	**S**	**S**
F- test	2.797	2.564	2.139	0.498	0.454	0.311
S. Ed (±)	5.774	5.292	4.416	1.028	0.939	0.643
$CD_{0.05}$	9.01	8.20	6.87	7.82	6.91	4.81
CV	42.0	41.8	41.9	6.2	5.4	5.8

Table No. 2 Response of bio-stimulants on No. of flowers/stalk and flower length in Asiatic lily plants

	No. of flowers/stalk			**Flower length (cm)**		
	2021-22	**2022-2023**	**Pooled data**	**2021-22**	**2022-2023**	**Pooled data**
Treatment	2.6	2.5	2.5	10.1	10.5	10.3
T_1- Control	2.7	2.7	2.7	11.3	11.4	11.3
T_2- 10 ppm Triacontanol	3.0	2.7	2.8	11.5	11.6	11.6
T_3-15 ppm Triacontanol	3.0	2.7	2.9	11.9	11.7	11.8
T_4-20 ppm Triacontanol	3.3	3.3	3.3	12.9	13.3	13.1
T_5- 25 ppm Triacontanol	3.1	3.0	3.1	12.5	12.4	12.5
T_6- 5 ppm Brassinolide	3.3	3.1	3.2	12.6	12.5	12.6
T_7-10 ppm Brassinolide	3.4	3.5	3.4	13.5	13.3	13.4
T_8-15 ppm Brassinolide	3.8	3.7	3.8	14.9	15.1	15
T_9-20 ppm Brassinolide	3.1	3.1	3.1	12.3	12.5	12.4
T_{10}-100 ppm Nitrobenzene	3.2	3.0	3.1	13.2	12.7	12.9
T_{11}- 200 ppm Nitrobenzene	3.3	3.3	3.3	13.2	13.0	13.1
T_{12}-300 ppm Nitrobenzene	3.4	3.3	3.3	13.3	13.1	13.3
T_{13}- 400 ppm Nitrobenzene	**S**	**S**	**S**	**S**	**S**	**S**
F- test	0.131	0.129	0.060	0.767	0.829	0.564

S. Ed (±)	0.272	0.268	0.126	1.585	1.712	1.164
$CD_{0.05}$	5.09	5.18	2.39	7.55	8.10	5.53
CV	2.6	2.5	2.5	10.1	10.5	10.3

Table No. 3 Response of bio-stimulants on flower diameter and no. of flowers/plot in Asiatic lily plants

	Flower diameter (cm)			**No. of flowers/plot**		
	2021-22	**2022-2023**	**Pooled data**	**2021-22**	**2022-2023**	**Pooled data**
Treatment	10.3	11.7	10.2	7.3	7.0	7.1
T_1- Control	13.6	14.0	13.8	8.0	8.0	8.0
T_2- 10 ppm Triacontanol	14.2	14.7	14.5	8.3	8.0	8.1
T_3-15 ppm Triacontanol	14.3	14.8	14.6	8.3	8.6	8.5
T_4-20 ppm Triacontanol	15.3	15.8	15.5	8.6	8.6	8.6
T_5- 25 ppm Triacontanol	14.3	14.7	14.5	8.3	8.3	8.3
T_6- 5 ppm Brassinolide	14.3	14.8	14.6	8.6	8.3	8.5
T_7-10 ppm Brassinolide	15.8	15.9	15.7	8.8	8.6	8.6
T_8-15 ppm Brassinolide	16.1	16.7	16.4	9.0	9.0	9.0
T_9-20 ppm Brassinolide	15.0	14.4	14.7	8.3	7.3	7.8
T_{10}-100 ppm Nitrobenzene	14.6	14.7	14.6	8.6	8.6	8.6
T_{11}- 200 ppm Nitrobenzene	14.3	14.7	14.4	8.3	8.3	8.3
T_{12}-300 ppm Nitrobenzene	14.7	14.9	14.8	8.6	8.6	8.6
T_{13}- 400 ppm Nitrobenzene	**S**	**S**	**S**	**S**	**S**	**S**
F- test	0.752	0.920	0.679	0.408	0.496	0.400
S. Ed (±)	1.553	1.900	1.403	0.843	1.025	0.827
$CD_{0.05}$	6.43	7.50	5.67	5.93	7.71	6.03
CV	10.3	11.7	10.2	7.3	7.0	7.1

Table No. 4 Response of bio-stimulants on no. of flowers/m^2 in Asiatic lily plants

	No. of flowers/m^2		
Treatment	2021-22	2022-23	Pooled
T_1- Control	27.1	25.9	26.5
T_2- 10 ppm Triacontanol	29.6	29.6	29.6
T_3-15 ppm Triacontanol	30.8	29.6	30.2
T_4-20 ppm Triacontanol	30.8	32.0	31.4
T_5- 25 ppm Triacontanol	32.0	32.0	32.6
T_6- 5 ppm Brassinolide	30.8	30.8	30.8
T_7-10 ppm Brassinolide	32.0	30.8	31.4
T_8-15 ppm Brassinolide	32.0	32.0	32.0
T_9-20 ppm Brassinolide	33.3	33.3	33.3
T_{10}-100 ppm Nitrobenzene	30.8	27.1	28.9
T_{11}- 200 ppm Nitrobenzene	32.0	32.0	32.0
T_{12}-300 ppm Nitrobenzene	30.8	32.0	31.4
T_{13}- 400 ppm Nitrobenzene	32.0	33.3	32.6
F- test	**S**	**S**	**S**
S. Ed (±)	1.510	1.693	1.420
$CD_{0.05}$	3.118	3.494	2.932
CV	5.93	7.40	6.00

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