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Efficacy of Foliar Application of Plant Growth Regulators on Flowering, Quality and Yield Aspects of Spider Lily (*Hymenocallis littorallis* L.)

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ABSTRACT: The experiment was undertaken in Department of Floriculture and Landscape Architecture, College of Horticulture, Junagadh, Junagadh Agricultural university during the academic year 2022-2023, to Determining the optimal dosage and timing of application different level of foliar application of Gibberellic acid (GA_3), Naphthalene acetic acid (NAA) and Brassinosteroid (BRs) on spider lily (*Hymenocallis littorallis* L.) to achieve desired outcomes in terms of flowering, quality, and yield, as these parameters can be influenced by various environmental factors and plant-specific responses. Additionally, ensuring uniform coverage and absorption of the growth regulators across a diverse population of spider lilies can be a logistical challenge in large-scale cultivation. In this experiment, the treatments considered were GA_3 (200 ppm and 250ppm), NAA (150 ppm and 250 ppm), BRs (3 ppm and 5 ppm). The experiment was laid out in Randomized Block Design (RBD) with four replications. Results of the experiment showed a significant that GA_3 @ 250 ppm recorded maximum spike length(75.37 cm), flower bud length (21.99 cm), flower bud diameter (1.20 cm), flower diameter (22.92 cm), days taken for first spike emergence (52.01 days),number of flower spike per plant (7.30), number of flowers per spike (16.78), number of flowers per plant (119.01), number of flowers harvested per net plot (28.52 bundles), yield of flowers (88032.41 bundles/ha), shelf life of flower (32.06 hour) and *in-situ* longevity of flower.

Keywords: GA_3, NAA, BRs, Flowering, yield, quality, spider lily.

INTRODUCTION

Spider lily (*Hymenocallis littoralis* L.) is native to South America and belongs to the family Amaryllidaceae. It is capable of withstanding temperatures that drop into the 40 ºF (4 °C) range, and as high as 90 ºF (32 ºC). It is a bulbous aesthetically pleasing plant, which is 60-90 cm tall and has long, broad and strap shaped green leaves. The shape of flower petals looks like a claw of spider and that is why the flower is name as Spider lily. The bulb is 7 to 10 cm (in diameter). In South Gujarat and Maharashtra, it is currently the most important commercial flower crop. The spider lily flowers are frequently utilized in religious events, weddings, man dap decorating and other religious ceremonies. The total area under commercial production of spider lily is 3715 ha with 36,986 MT production and 9.96 MT/ha productivity in Gujarat (Anon., 2021-22).Stamen filaments are green, and narrow petals have a thin membrane between them, which probabaly explains the origin of its scientific name. Response of flowering plants to growth regulators treatments are being studied with a view of having compact plants with greater number of flowers and also to hasten or delay flowering according to the needs of growers (Yawale *et al.*, 1998). Thus, the usage of plant growth regulators becomes important in order to understand the situation and discover the simple solution to improve the quality of flowers in all relevant respects.

Plant hormones control physiological processes, and synthetic growth regulators can improve the quality and yield of the flowers. Use of plant growth regulators increased dry matter in crops because of the enhanced carbohydrate buildup brought on by a more effective photosynthetic activity caused by the anatomical changes (Sowjanya *et al*. (2022).A dramatic increase in number of flowers was observed when plant growth regulators applied. Plant Growth Regulators are known to enhance the source sink relationship and stimulate the translocation of photo assimilates thereby helping better flower set (Himansh *et al.*, 2023). The present study was, therefore, conducted with suggested concentration of imposed PGRs as foliar spray to determine the effective growth regulators promoting flowering, quality and yield components of spider lily. Gibberellic acid induces stem and internodes elongation, seed germination, enzyme production during germination and fruit setting and growth

(Kumar *et al*., 2012). The application of gibberellic acid is reported to increase leaf size, petiole length, whereas the application of auxins is also known to impart similar effects (Sujit *et al*., 2023).

MATERIAL AND METHODS

The experiment was conducted in Randomized Block Design with seven treatment and three replications at Department of Floriculture and Landscape Architecture, College of Horticulture, Junagadh Agricultural university, Junagadh during the academic year 2022-2023. Three growth regulators were used as the treatments *viz*., GA_3 (200 ppm and 250 ppm), NAA (150 ppm and 250 ppm), BRs (3 ppm and 5 ppm) and Control (Water spray). Treatment was applied two times, First at 45 days and second at 60 days after deleafing respectively. The observation was recorded from five random plants in each replication.

RESULTS AND DISCUSSION

Effect of foliar application of Plant Growth Regulators on flowering and quality attributes of spider lily.

Flower bud length and bud diameter. The perusal of data from Table 1 revealed that the highest flower bud length (Plate 2) and bud diameter (21.99 and 1.20 cm) was recorded in T_2*i.e.*, GA_3 @ 250 ppm which may be related to the increased activity of growth-promoting enzymes as a result of the production of more nucleic acid and other compounds. Similar results were recorded by Sanjay Kumar *et al*. (2019) in amaryllis, Prasad *et al.* (2002) in Gladiolus.

Flower diameter. The maximum flower diameter (22.92 cm) was noticed in treatment T_2(GA_3 @ 250 ppm) and it was at par with treatment T_1(22.33 cm).

This might be due to the translocation of metabolites at the site of bud development.GA_3 promotes petal growth and flower organ development. Increase in length of petals and pedicels might be due to cell elongation in the flower. Gibberellins are also known to increase the sink strength of actively growing parts. This data can be correlated with the findings of Parmar *et al.* (2009) and Sonone and Rahul (2019) in spider lily, Misra *et al.* (2000) in football lily, Sanjay Kumar *et al.* (2019) in amaryllis, Singh (1999); Tak and Nagda (1999) in tuberose, Khuriwal *et al.* (2018) in dahlia.

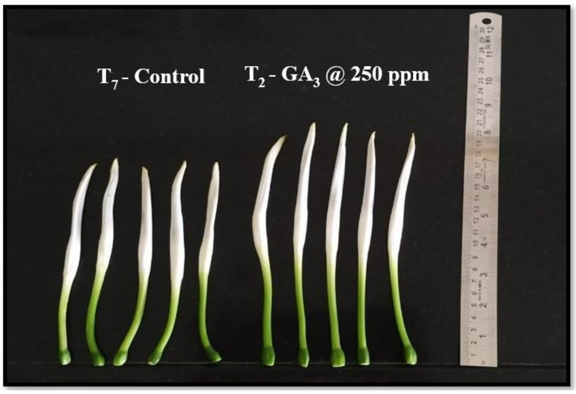

Plate 1. Effect of plant growth regulators on flower bud length (cm) of spider lily.

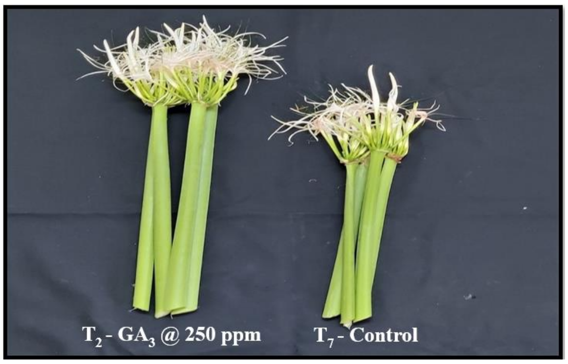

Plate 2. Effect of plant growth regulators on spike length (cm) of spider lily.

Shelf life of flower. Shelf life of flower was highest (32.06 hour) in the treatment GA_3 @ 250 ppm which was at par with T_4 (30.48 hour) *i.e.* NAA @ 250 ppm.

This might be due enhanced biomass in GA_3 treated plants, better partitioning of these assimilates into the reproductive parts results in increased flower fresh and dry weight. Increased carbohydrate sources within the plants were used after harvesting of the cut stems for their metabolic reactions. In case of untreated plants having lower fresh weight with less food reserves might be leads to early senescence of the cut flowers compared to GA_3 treated flowers. Increased membrane leakage was observed with untreated plants compared to GA_3 treated plants leads to earlier senescence of untreated flowers

The results are in similar trend with results obtained by findings of Pushpa *et al.* (2022) in lupin, Sonone and Rahul (2019) in spider lily, Kumar and Gupta (2014) in gladiolus, Singh *et al.* (2013) in tuberose.

Effect of foliar application of plant growth regulators on yieldattribute of spider lily

Days taken for spike emergence. The data presented in Table 2 revealed that significantly the lowest days (52.01) required days taken for spike emergence was noticed in T_2 *i.e.* GA_3 @ 250 ppm and it was followed by T_1 (53.52). Whereas, the plant without any treatment *i.e.* T_7@ control recorded the highest days (60.57) to days taken for spike emergence.

It might be due to the effect of GA_3 on shortening the juvenile stage of plants, which results in early completion of the vegetative phase through rapid cell division and cell elongation. Similar findings were obtained by Sujit *et al.* (2023) in rain lily, Chaitra *et al.* (2020); Sonone and Rahul (2019) in spider lily.

Spike length. From the data depicted in Table 2 revealed that maximum spike length (75.37 cm) was recorded in T_2@ GA_3 250 ppm and is statistically on par with GA_3 @ 200 ppm (72.00 cm) and minimum spike length (64.78 cm) was recorded in T_7 *i.e.* control (Plate 2).

This may be due to rapid cell division and cell elongation or both. Similar results were recorded by Parmar *et al.* (2009); Parekh *et al.* (2018) in spider lily.

Number of flower spike per plant. The highest number of flower spike per plant (7.30) recorded in T_2 *i.e.* GA_3 @ 250 ppm which was statistically on par with T_4 ((6.74).

This might be due to the increased number of leaves which is vital for the production of abundant carbohydrates in the plant and consequently, the carbohydrates are translocated towards the reproductive part of the plants for the initiation of spikes. The results were similar to the results obtained by Parmar *et al.* (2009) in spider lily, Das *et al.* (1992) in day lily, Jadhav *et al.* (2015); Singh *et al.* (2019) in gladiolus.

Number of flowers per spike. The maximum Number of flowers per spike (16.78) was noticed in T_2 *i.e.* GA_3 @ 250 ppm which was found at par with T_6 (16.44).

This might be due to the increase in photosynthesis and respiration with enhanced carbohydrate fixation in GA_3 treated plants. The similar result was confirmed with Parmar *et al.* (2009) in spider lily, Ravidas *et al.* (1992); Mahesh and Misra (1993); Pal and Chowdhary (1998); Maurya and Nagda (2002); Barman and Rajni (2004); Baskaran *et al.* (2014); Ashvini *et al.* (2019) in gladiolus, Amin *et al.* (2017); Singh *et al.* (2013); Tak and Nagda (1999); Singh (1999) in tuberose.

Number of flowers per plant. The significantly maximum number of flowers per plant (119.01) was recorded with application of GA_3 @ 250 ppm as compared to treatment T_7 (64.04).

This result might be due to the production of a greater number of flower spike per plant and increase in flower production per spike. The similar results were observed with those reported by Sonone and Rahul (2019) in spider lily, Khuriwal *et al.* (2018) in dahlia.

Table 1: Effect of foliar application of plant growth regulators on flowering and quality attribute of spider lily.

Sr. No.	Treatment	Flower bud length (cm)	Flower bud diameter (cm)	Flower diameter (cm)	*In-situ* longevity of flower (days)	Shelf life of flower (hours)
T_1	GA_3 @ 200 ppm	19.77	1.05	22.33	2.05	28.48
T_2	GA_3 @ 250 ppm	21.99	1.20	22.92	2.06	32.06
T_3	NAA @ 150 ppm	18.30	0.89	20.83	2.04	29.09
T_4	NAA @ 250 ppm	19.84	0.91	21.92	2.07	30.48
T_5	Brassinosteroid @ 3 ppm	17.90	0.81	21.35	2.03	27.85
T_6	Brassinosteroid @ 5 ppm	18.11	0.72	21.36	2.00	27.20
T_7	Control	17.13	0.66	18.72	2.07	25.60
S.Em. ±		0.87	0.04	0.71	0.08	0.67
C.D. at 5 %		2.57	0.11	2.12	NS	1.98
C.V. %		9.16	8.42	6.70	7.96	4.64

Table 2: Effect of foliar application of plant growth regulators on yield attribute of spider lily.

Sr. No.	Treatment	Days taken for first spike emergence	Spike length (cm)	Number of flower spike per plant	Number of flowers per spike	Number of flowers per plant	Number of flowers harvested per net plot (bundles)	Yield of flowers (bundles/ha)
T_1	GA_3 @ 200 ppm	53.52	72.00	6.36	12.36	104.04	24.88	76797.86
T_2	GA_3 @ 250 ppm	52.01	75.37	7.30	16.78	119.01	28.52	88032.41
T_3	NAA @ 150 ppm	56.25	69.62	6.28	14.30	88.69	21.28	65611.73
T_4	NAA @ 250 ppm	54.66	70.24	6.74	15.59	96.35	23.12	71358.03
T_5	Brassinosteroid @ 3 ppm	55.03	68.03	5.84	15.61	91.16	23.31	71936.72
T_6	Brassinosteroid @ 5 ppm	57.12	67.94	5.85	16.44	78.48	18.83	58125.00
T_7	Control	60.57	64.78	4.99	12.88	64.04	15.43	47608.02
S.Em. ±		1.58	1.87	0.31	0.88	3.60	0.85	2603.18
C.D. at 5 %		4.70	5.56	0.93	2.60	10.69	2.52	7734.44
C.V. %		5.69	5.37	10.07	11.79	7.85	7.64	7.60

Number of flowers harvested per net plot. The higher number of flowers harvested per net plot was noticed with the treatment T_2(28.52 bundles) *i.e.* GA_3 @250 ppm, while minimum number of flowers harvested per net plot (15.43 bundles) was recorded in T_7.

This might be due to the availability of desirable food materials and more carbohydrate supply which ultimately effects on flower production. Increase in number of flowers per plant directly increase the number of flowers harvested per net plot (bundle). This result is in accordance with the findings of Khan and Tewari (2003) in dahlia; Maurya and Nagda (2002) in gladiolus; Tak and Nagda (1999) in tuberose.

Yield of flowers. The plant treated with T_2 *i.e.*GA_3@ 250 ppm produce highest (88,032.41 bundles/ha) flower yield per hectare, while minimum yield of flowers was recorded in T_7 (88,032.41 bundles/ha).

The increase in yield and yield parameters with GA_3 spraying was due to better crop growth, thus increased the number of flowers per plant and ultimately increased the flower yield. This might be due to the fact that optimum level of GA_3 promoted the efficacy of plants in terms of photosynthetic activity enhanced the uptake of nutrients and their translocation, better partitioning of assimilates into reproductive parts. This can be attributed to translocation of source to sink. Similar results were recorded by Bijay *et al.* (2023) in litchi, Parmar *et al.* (2009); Sonone and Rahul (2019); Chaithra *et al.* (2020) in spider lily, Sanjay Kumar *et al.* (2019) in amaryllis, Ashvini *et al.* (2019) in gladiolus, Amin *et al.* (2017) in tuberose, Khuriwal *et al.* (2018) in dahlia.

CONCLUSIONS

In the current study, foliar application of plant growth regulators increased spider lily flowering, quality and yield, and based on the current experimental results, it can be concluded that foliar application of GA_3 @ 250 ppm outperformed other plant growth regulator treatments, followed by treatment with GA_3@ 200 ppm.

FUTURE SCOPE

Future studies using other plant growth regulators are necessary to evaluate the impact of combining different plant growth regulators on spider lily development, flowering, quality, and yield.

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Conflict of Interest. None.

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