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Optimization of pinching and GA_3 application to improve growth and flowering of lisianthus (*Eustoma grandiflorum*)

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Abstract
An experiment was conducted at the Horticultural Research Station of the Tamil Nadu Agricultural University at Ooty in the Nilgiris District of Tamil Nadu to optimize pinching coupled with GA_3 application to improve the growth, yield and quality characters of lisianthus (*Eustoma grandiflorum* [Raf.] Shinn.) for cut flower production under polyhouse. The study was taken up in the variety 'Mariachi Blue'. The experiment was laid out in Factorial Randomized Block Design with 9 treatments in three replications. The treatments consisted of two levels of pinching (single and double) and spraying of gibberellic acid (GA_3 @ 50, 100 and 150 ppm). GA_3 was applied as a foliar spray at 30 days after pinching before formation of flower buds. The results revealed that the vegetative growth characters namely, plant height (66.33 cm) and internodal length (9.41cm) and quality character namely, flower stem length (63.33cm) were highest in the treatment T_5 (Single pinching + GA_3 @ 150 ppm). The highest number of side shoots (7.32) and number of leaves (41.79) per plant were recorded with T_9 (Double pinching + GA_3 @ 150 ppm). Considering the overall performance, it was noticed that the plants subjected to single pinching and foliar spraying with GA_3 @ 150 ppm recorded superior performance in lisianthus.

Keywords: Lisianthus, *Eustoma grandiflorum*, single pinching, double pinching, growth regulator

Introduction
Lisianthus is a relatively new cut flower crop when compared with other commercial floricultural crops like cut roses, carnations and chrysanthemums that have been grown as commercial cut flowers for many decades. Yet, lisianthus has made a tremendous impact on the global cut flower trade. It was first available in Japan during 1933 and became the number one cut flower with over 129 million stems sold during 2001. In Europe, it is ranked as one of the top 10 cut flowers and in the United States, the popularity of this flower crop continues to grow not only as a cut flower but also as a bedding plant and pot plant. As far as India is concerned, Lisianthus is a relatively new cut flower. In Tamil Nadu, production of lisianthus is concentrated in limited area in the hill stations namely, Ooty and Kodaikanal. Lisianthus is a crop which has immense potential as cut flower and pot plant. However, the research reports available on lisianthus is meagre. The present research work was undertaken to study the influence of pinching practices and growth regulator application on the growth and flowering of lisianthus.

Materials and Methods
The experiment was conducted under polyhouse condition in the farm of the Horticultural Research Station of Tamil Nadu Agricultural University, in The Nilgiris during 2018-19. The variety Mariachi Blue was involved in the study. The experiment was carried out in a Factorial Randomized Block Design (FRBD) with three replications. The treatments consisted of two levels of pinching (single and double) and spraying of gibberellic acid (GA_3 @ 50, 100 and 150 ppm). Single and double pinching was done at 30 and 45 days after transplanting respectively. GA_3 was applied as foliar spray at 30 days after pinching before formation of flower buds.

Data were collected on plant height (cm), internodal length, flower stem length, number of side shoots per plant, number of leaves/plant, number of flowers/plant. The datawere statistically analyzed using SPSS program. Mean values for all the treatments were calculated and the analysis of variance for each of the character was performed by F test. Difference between treatments was evaluated by DMRT at 5% level of significance.

Show the treatment

Treatments	Treatments
T_1	Control
T_2	Single pinching + without GA_3
T_3	Single pinching + GA @ 50 ppm
T_4	Single pinching + GA @ 100 ppm
T_5	Single pinching + GA @ 150 ppm
T_6	Double pinching + without GA_3
T_7	Double pinching + GA @ 50 ppm
T_8	Double pinching + GA @ 100 ppm
T_9	Double pinching + GA @ 150 ppm

Results and Discussion

Number of leaves /plant: Number of leaves/plant varied significantly after the terminal bud pinching in lisianthus. Maximum numbers of leaves / plant (41.79) was found in T_9 (Double pinching + GA_3 @ 150 ppm) followed by T_5 (Single pinching +GA_3 @150 ppm), (38.00) and minimum (25.84) in T_1 control (Table. 2). the higher number of side shoots is also associated with higher number of leaves. Similar trend was also observed previously in chrysanthemum (Habiba *et al*. 2012) [4] and *Calendula officinalis* (Singh and Sharma, 1994) [10].

Number of side shoots/plant: Number of side shoots/plant significantly varied in lisianthus after terminal bud pinching. Maximum number of side shoots /plant (7.32) was found in T_9 (Double pinching + GA_3 @ 150 ppm), followed by T_5 (Single pinching +GA_3 @150 ppm), (6.65) and minimum (3.29) in control T_1 (Control). (Table. 2) In the process of pinching, when the terminal bud is removed from the plant, it induces stress and the plant requires time to overcome this condition; and the growth is hampered initially. Pinching temporarily reduces auxin which eliminates the apical dominance. This enables the side shoot buds to start growing (Habiba *et al*., 2012) [4], This observation is in line with the earlier reports in lisianthus. (Jamal Uddin *et al*., 2015) [1].

Plant height: In the present study, significant variation was recorded for plant height due to terminal bud pinching in lisianthus. The maximum plant height (71.84cm) was recorded in T_1(Obsolete control) and followed by T_5 (Single pinching + GA_3 @150 ppm), (66.33cm) minimum (38.81cm) in T_6 (Double pinching without GA_3). (Table. 2) This observation is in line with the earlier reports in lisianthus (Sailaja and Panchbhai, 2014) [9], chrysanthemum (Habiba *et al*., 2012 and Rakesh *et al*., 2003) [4, 6], in China aster (Pavan Kumar *et al*. 2014,) [5] and dahlia (Vieira, Marcos & Lima *et al*., 2011) [2].

Internodal length: Significant variation was observed in internodal length after terminal bud pinching. Maximum internodal length (9.41cm) was found in T_5 (Single pinching +GA_3 @150 ppm). Minimum internodal length (5.48cm) was observed in T_1 (Control), (Table 2). The better plant growth at T_5 observed may be due to pinching and application of gibberellic acid which might have enhanced cell division and cell enlargement, promotion of protein synthesis coupled with dry matter accumulation. A similar trend was observed previously in China aster (Sailaja and Panchbhai 2014) [9]. This finding is in accordance with the results obtained by Tannirwar *et al.* (2011) [12] in chrysanthemum.

Number of flowers/plant: In case of number of flower buds/plant, significant variation was observed with pinching. Maximum flowers/plant (16.68) was found in T_5 (Single pinching + GA_3 @ 150 ppm) and minimum (5.60) in T_1 (control) (Table. 3). The increase in number of flowers might be due to production of large number of laterals at early stage due to single pinching, which had sufficient time to accumulate reserve carbohydrates for proper flower bud differentiation. GA_3 promoted axillary buds to grow vigourously, enhancing the available substrate at the time of floral initiation and thus promoting flower production. It might be the main reason for the production of more number of flowers per plant. These result are also in close conformity with the findings of Suresh Kumar *et al*, (2008) [11] in gladiolous. These findings are also in accordance with those of Rakesh *et al*. (2003) [6] in carnation, India. Rameshkumar, Singh, K. and Reddy, B. S. (2002) [3] in carnation, Tannirwar *et al.* (2011) [12] in chrysanthemum cv. Zipri. And Ryagi *et al*. (2007) [7] in Carnation.

Flower stem length: Flower stem length significantly varied in lisianthus after terminal bud pinching. Maximum stem length (68.84cm) was found in T_1 Control, and followed by T_5 (Single pinching + GA_3 @ 150 ppm), (63.33cm) whereas minimum was found in T_6 (Double pinching without GA_3), (35.81cm) (Table. 3). In many flower crops, when GA_3 is applied externally, it causes marked elongation of stem and as a result, such plants grew taller. The increase in length might be because of rapid elongation of intemodes which may be again due to increase in cell division and enlargement, which is mostly confined to sub-apical meristem. The plants treated with GA_3 have higher mitotic index in the sub-apical meristem and there might have been enhanced cell division in this region. The better plant growth observed may be due to the gibberellic acid which enhances cell division and cell enlargement, promotion of protein synthesis coupled with dry matter accumulation. Stimulation of branching may be possible due to the breakage of apical dominance. This finding of flower stem length was in accordance with the results obtained by Singh (1994), Rakesh *et al.* (2003) [6], Tannirwar *et al.* (2011) [12] in chrysanthemum, Sunitha, and R. Hanje, (2007) [8] in marigold.

Table 1: Effect of pinching and GA_3 on vegetative growth parameters of lisianthus variety Mariachi blue

Treatments (G)		Number of leaves	Number of side shoots per plant	Plant height (cm)	Internodal length (cm)
T_1	Control	33.52	3.29	71.84	5.48
T_2	Single pinching without GA_3	25.84	4.13	50.67	6.97
T_3	Single pinching + GA_3 @ 50 ppm	31.65	5.76	53.32	8.04
T_4	Single pinching + GA_3 @ 100 ppm	34.40	6.25	55.41	8.66
T_5	Single pinching + GA_3 @ 150 ppm	38.00	6.65	66.33	9.41
T_6	Double pinching without GA_3	22.23	5.80	38.81	6.20
T_7	Double pinching + GA_3 @ 50 ppm	38.27	6.09	42.98	8.18
T_8	Double pinching + GA_3 @ 100 ppm	39.49	6.59	44.60	8.64
T_9	Double pinching + GA_3 @ 150 ppm	41.79	7.32	55.11	9.19

Mean	33.91			5.76			53.23			7.86		
	P	G	PXG	P	G	PXG	P	G	PXG	P	G	PXG
SE(d)	1.648	2.331	3.240	0.274	0.388	0.549	1.668	2.359	3.336	0.098	0.138	0.196
CD (P=0.05)	3.535*	5.00**	NS	0.589**	0.834**	1.179**	3.578**	5.060**	NS	0.210	0.297**	0.421**

Table 2: Effect of pinching and GA_3 on flowering parameters of lisianthus variety Mariachi blue

Treatments (G)		Flower stem length (cm)			Number of flowers per plant		
T_1	Control	68.84			5.60		
T_2	Single pinching without GA_3	47.67			7.85		
T_3	Single pinching + GA_3 @ 50 ppm	50.32			11.71		
T_4	Single pinching + GA_3 @ 100 ppm	52.41			14.64		
T_5	Single pinching + GA_3 @ 150 ppm	63.33			16.68		
T_6	Double pinching without GA_3	35.81			6.67		
T_7	Double pinching + GA_3 @ 50 ppm	39.98			9.66		
T_8	Double pinching + GA_3 @ 100 ppm	41.60			11.81		
T_9	Double pinching + GA_3 @ 150 ppm	52.11			13.13		
Mean		50.23			10.86		
		P	G	PXG	P	G	PXG
SE(d)		1.668	2.359	3.336	0.523	0.739	1.046
CD (P=0.05)		3.578**	5.061**	NS	1.122**	1.586**	NS

Conclusion

Significant differences among different pinching and GA_3 foliar spraying treatments were found in case of various growth and flowering attributes in lisianthus variety Mariachi Blue. The study led to the inference that single pinching + GA_3 @ 150 ppm produced favourable results with respect to flower yield and stem length, in comparison to other treatments. Though double pinching led to induction of stress in the plant resulting in production of higher number of flowers, the quality of flowers was found to be inferior.

References

1. Jamal Uddin AFM, Shahrin S, Ahmad H, Rahman SKS, Shimasaki K. Influence of terminal bud pinching on growth and flowering of Lisianthus (*Eustoma grandiflorum*). Int. J Bus. Soc. Sci. Res. 2015; 4(1):37-40.
2. Vieira, Marcos Lima, Giuseppina Souza, Angela Costa, PN Santos, Caio Alves L, Oliveira NG. Effect of gibberellic acid on the quality of chrysanthemum (*Dendranthema grandiflora* L.) cv. Faroe. African Journal of Biotechnology. 2011; 10:15933-15937. 10.5897/AJB11.79.
3. Rameshkumar Singh K, Reddy BS. Effect of planting time, photoperiod, GA3 and pinching on carnation. Journal of Ornamental Horticulture. 2002; 5:20-23.
4. Habiba SU, Islam MS, Jamal Uddin AFM. Influence of terminal bud pinching on growth and yield of chrysanthemum, (*Chrysanthemum indicum* L). Journal of Bangladesh Academy of Sciences. 2012; 36(2):251-255,
5. Pavan Kumar K, Padmalatha T, Pratap M. Effect of spacing and pinching on vegetative growth in China aster (*Callistephus chinensis* L. Nees) cv. Kamini. Plant Archives. 2014; 14(2):961- 966.
6. Rakesh RS, Singhrot S, Beniwal BS, Moond SK. Effect of GA_3 and pinching on flowering in Chrysanthemum. Haryana J of Horti. Sci. 2003; 34(1-2):95-96.
7. Ryagi VY, Mantur SM, Reddy BS. Effect of pinching on growth, yield and quality of flowers of Carnation varieties grown under polyhouse. Karnataka J Agric. Sci. 2007; 20(4):816-818.
8. Sunitha HM, Hanje R, Vyakaranahal BS, Bablad HB. Effect of pinching and growth regulators on plant growth, flowering and seed yield in African marigold (*Tagetes erecta* L.). Journal of Ornamental Horticulture. 2007; 10(2):91-95.
9. Sailaja SM, Panchbhai DM. Effect of pinching on growth and quality characters of China aster varieties. Asian J Hort. 2014; 9(1):36-39.
10. Singh DK, Sharma KK. Effect of GA3 and alar on growth, flowering and seed production of dahlia (*Dahlia variabilis* L.). Orissa Journal of Horticulture. 1994; 22:10-12.
11. Suresh Kumar P, Bagawathi R, Rajive Kumar, Ronya T. Effect of plant growth regulators on vegetative growth, flowering and corm production of gladiolous in Arunachal Pradesh. J of Orn. Horti. 2008; 10(2):90-95.
12. Tannirwar AV, Dange Nr, Brahmankar SB. Effect of growth regulators and nutrients on growth and flowering of chrysanthemumcv. Zipri. The Asian J of Horti. 2011; 6(1):269-270.