Optimization of pinching and GA$_3$ application to improve growth and flowering of lisianthus 
(*Eustoma grandiflorum*)

Kathari Lakshmaiah, S Subramanian, M Ganga and P Jeyakumar

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 (9.41 cm) and quality character namely, flower stem length (63.33 cm) were highest in the treatment T$_6$ (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$_7$ (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 data were 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.

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

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<td>T9</td>
<td>Double pinching + GA @ 150 ppm</td>
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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 T6 (Double pinching + GA3 @ 150 ppm) followed by T3 (Single pinching +GA3 @ 150 ppm), (38.00) and minimum (25.84) in T1 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) [1] 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 T5 (Double pinching + GA3 @ 150 ppm), followed by T3 (Single pinching +GA3 @ 150 ppm), (6.65) and minimum (3.29) in control T1 (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 T1 (Obsolete control) and followed by T3 (Single pinching + GA3 @ 150 ppm), (66.33cm) minimum (38.81cm) in T6 (Double pinching without GA3). (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 T3 (Single pinching +GA3 @150 ppm). Minimum internodal length (5.48cm) was observed in T1 (Control), (Table 2). The better plant growth at T3 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 T5 (Single pinching + GA3 @ 150 ppm) and minimum (5.60) in T1 (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. GA3 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 T1 Control, and followed by T5 (Single pinching + GA3 @ 150 ppm), (63.33cm) whereas minimum was found in T6 (Double pinching without GA3), (35.81cm) (Table. 3). In many flower crops, when GA3 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 internodes which may be again due to increase in cell division and enlargement, which is mostly confined to sub-apical meristem. The plants treated with GA3 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, Sunita, and R. Hanje, (2007) [8] in marigold.

<table>
<thead>
<tr>
<th>Treatments (G)</th>
<th>Number of leaves</th>
<th>Number of side shoots per plant</th>
<th>Plant height (cm)</th>
<th>Internodal length (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 Control</td>
<td>33.52</td>
<td>3.29</td>
<td>71.84</td>
<td>5.48</td>
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<tr>
<td>T2 Single pinching without GA3</td>
<td>25.84</td>
<td>4.13</td>
<td>50.67</td>
<td>6.97</td>
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<td>T3 Single pinching + GA @ 50 ppm</td>
<td>31.65</td>
<td>5.76</td>
<td>53.32</td>
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<td>6.25</td>
<td>55.41</td>
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<td>T5 Single pinching + GA @ 150 ppm</td>
<td>38.00</td>
<td>6.65</td>
<td>66.33</td>
<td>9.41</td>
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<tr>
<td>T6 Double pinching without GA3</td>
<td>22.23</td>
<td>5.80</td>
<td>38.81</td>
<td>6.20</td>
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<td>6.09</td>
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<td>T8 Double pinching + GA @ 100 ppm</td>
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<td>6.59</td>
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<td>8.64</td>
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<td>T9 Double pinching + GA @ 150 ppm</td>
<td>41.79</td>
<td>7.32</td>
<td>55.11</td>
<td>9.19</td>
</tr>
</tbody>
</table>

Table 1: Effect of pinching and GA3 on vegetative growth parameters of lisianthus variety Mariachi blue
Conclusion
Significant differences among different pinching and GA₃ 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 + GA₃ @ 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