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# The Effect of Growth Inhibitors on the Growth, Roots, and Flowering Attributes of Crossandra (*Crossandra infundibuliformis*) in Pot

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**ABSTRACT: Under potted conditions, application of MH @ 600 ppm resulted in maximum, number of leaves per plant and root-shoot ratio as compared to other treatments. The maximum length of the leaves was observed in the control plants which was followed by cycocel @ 500 ppm. Foliar application of cycocel @ 1500 ppm recorded the maximum leaf width when compared to other treatments. Significant differences were observed with the various flowering attributes upon the application of growth retardants. It was observed that maleic hydrazide @ 600 ppm recorded maximum florets per spike, longevity of spike in field, longevity of florets on the spike. The maximum floret length was observed with cycocel @ 1500 ppm. The minimum length of floret, longevity of spike in the field and longevity of floret on spike was observed with the application of paclobutrazol @ 1500 ppm.**

**Keywords:** Crossandra, cycocel, paclobutrazol, maleic hydrazide.

## INTRODUCTION

Flowering ornamental plants are widely prized for their appealing appearance. Crossandra is one such attractive blooming plant. Crossandra belongs to the Acanthaceae family. C. *infundibuliformis* is grown commercially for flower production. Crossandra is also known as the “fire cracker plant” because the seed pods that emerge after flowering explode under high humidity conditions. It is grown commercially as potted plants in Denmark, Sweden, and Hungary (Bharathi *et al.,* 2018). It has gained significant relevance in contrast to other flower crops due to its perennial nature, year-round blossoming, minimal fertiliser usage, and increased profitability. Adopting good crop management practices has the potential to significantly increase crossandra output. One example is the use of plant growth inhibitors is one way. Growth inhibitors work by inhibiting the manufacture of gibberellins, limiting cell expansion activity and resulting in compact plants with dark green leaves. Synthetic plant growth retardants are gaining popularity in commercial floriculture due to their ability to manipulate the growth and development of ornamental crops in order to develop compact growth habitat by retarding excessive vegetative growth without affecting crop yield, resulting in early and quality blooming.

## MATERIALS AND METHODS

The current study was conducted at the ICAR-DFR Regional Centre in Vemagiri, East Godavari District. This site is in Agro-climatic Zone No. 10 (Godavari zone), which has a tropical savanna climate. The yearly rainfall average is 1017.67 mm. The average temperature ranges from a high of 51°C to a low of 16°C. The experiment used a Completely Randomised Design with ten treatments that were reproduced three times. Cycocel (500, 1000 and 1500 ppm), paclobutrazol (500, 1000, and 1500 ppm), and maleic hydrazide (200, 600, and 1000 ppm) are the therapies. One-month-old rooted cuttings of cv. Local Orange were planted in 6-inch pots. Cultural and managerial practises were addressed in a timely manner. 45 and 60 days after application, growth retardants were sprayed. MH and CCC were administered via foliar spray, whereas paclobutrazol was applied via soil soaking followed by foliar spray. The data was statistically analysed and is tabulated below.

## RESULTS AND DISCUSSION

*A. Growth Parameters*

The observations recorded pertaining to leaf length, leaf width, number of leaves per plant, fresh weight and dry weight of roots and root- shoot ratio is presented in Table 1.

It can be interpreted that, control plants have more leaf length of 12.40 cm which is followed by CCC @ 500 ppm (12.19 cm). Application of paclobutrazol @ 1500 ppm retarded the width (4.87 cm) of leaf to a greater extent compared to control plants (6.98 cm). The change observed in the leaf length might be due to the inhibitory action of growth retardants in the biosynthesis of gibberellins (Rademacher, 2000). They act by blocking the cytochrome P-450 dependent monooxygenases that leads to the hinderance of oxidation of *ent*- kaurene thus resulting in blocking the synthesis of active gibberellins. This might have resulted in plants with reduced height and leaf length (Mahgoub *et al.,* 2006). Similar results were reported by Thakur *et al.* (2006) in lilium plantlets. The leaf number per plant was found to increase with the application of CCC and maleic hydrazide when compared to control. Foliar application of MH @ 600 ppm ($T_9$) recorded 20.8% higher number of leaves (122.98) as compared to control (100.27). This increase might be attributed to the increase in the no. of branches/plant and the negligible or no effect of growth retardants on the leaf initiation, growth and development (Imran *et al.*, 2012). The results obtained were supported with the findings of Snehalata *et al.* (2019) in potted gerbera.

*B. Root Parameters*

The combined effect of drenching followed by foliar application of paclobutrazol @ 1500 ppm resulted in plants having least fresh weight and dry weight of roots (100.28 g and 19.80 g respectively) as compared to control plants (105.26 g and 21.95 g respectively), whereas, plants subjected of application of cycocel @1000 ppm had highest fresh weight and dry weight of roots (135.31 g and 33.25 g respectively). The difference in the root-shoot ratio among the treatments was found to be very meagre. When compared to control (0.11), the highest ratio was recorded in the treatment MH @ 600 ppm (0.15) that was found to be at par with CCC @ 1500 ppm (0.14). The least root-shoot ratio was found to be associated with the paclobutrazol @ 1500 ppm (0.07).

**Table 1: The effect of growth inhibitors on crossandra growth and rooting factors.**

| Treatments | Leaf Length (cm) | Leaf Width (cm) | No. leaves/ plant | Fresh weight of roots (g) | Dry weight of roots (g) | Root-Shoot ratio |
|---|---|---|---|---|---|---|
| $T_1$ Control (water spray) | 12.40 | 6.98 | 100.27 | 105.26 | 21.95 | 0.11 |
| $T_2$ CCC @ 500 ppm | 12.19 | 6.64 | 113.43 | 123.51 | 30.75 | 0.12 |
| $T_3$ CCC @ 1000 ppm | 12.11 | 7.30 | 119.78 | 128.24 | 32.37 | 0.13 |
| $T_4$ CCC @ 1500 ppm | 11.55 | 7.86 | 121.66 | 135.31 | 33.25 | 0.14 |
| $T_5$ Paclobutrazol @ 500 ppm | 9.49 | 5.02 | 109.78 | 118.9 | 23.68 | 0.10 |
| $T_6$ Paclobutrazol @ 1000 ppm | 9.34 | 4.98 | 101.32 | 106.75 | 21.24 | 0.09 |
| $T_7$ Paclobutrazol @ 1500 ppm | 9.10 | 4.87 | 96.45 | 100.28 | 19.8 | 0.07 |
| $T_8$ Maleic hydrazide @ 200 ppm | 12.10 | 6.28 | 114.37 | 109.89 | 21.17 | 0.11 |
| $T_9$ Maleic hydrazide @ 600 ppm | 12.00 | 6.57 | 122.98 | 130.27 | 26.53 | 0.15 |
| $T_{10}$ Maleic hydrazide @ 1000 ppm | 10.66 | 7.06 | 117.27 | 122.34 | 24.41 | 0.12 |
| **Mean** | **11.09** | **6.36** | **111.73** | **118.07** | **25.51** | **0.11** |
| SE m± | 0.17 | 0.09 | 1.71 | 0.47 | 0.28 | 0.03 |
| CD at 5% | 0.52 | 0.31 | 5.08 | 0.62 | 0.42 | 0.01 |

**Fig. 1.** Comparing the leaf size of control plants (left) and plants treated with paclobutrazol @ 1500 ppm (right).

*C. Flowering Parameters*

The observations recorded pertaining to number of florets per spike, length of floret, longevity of spike in field and longevity of floret on spike presented in Table 2.

An increase in the number of florets per spike was observed with the application of MH @ 600 ppm (8.95) as compared to control (7.18), whereas paclobutrazol @ 1000 ppm recorded least number of florets per spike (6.26). The variation observed in floret length was found to be very meagre. The maximum length of the floret (3.67 cm) was observed with the application of maleic hydrazide @ 1000 ppm ($T_{10}$). The minimum length of the floret (2.71 cm) was observed with the paclobutrazol treatment @ 1500 ppm ($T_7$) when compared to control (3.14 cm). The results obtained might be due to the physiological nature of paclobutrazol to act against the biosynthesis of gibberellins which are held responsible for the process of cell division and cell expansion. This might have led to the development of florets and spikes with reduced length (Mahgoub *et al.*, 2006). Corroboratory result was reported by Karuppaiah (2018) in crossandra.

From the table, it can also be interpreted that application of maleic hydrazide @ 600 ppm recorded the maximum longevity of spike in field (9.97 days) and longevity of florets on spike 4.26 days). The extended longevity in the plants that were treated with maleic hydrazide might be due to synthesis and availability of more photosynthates due to an increase in the leaf area and chlorophyll content of the leaves. They were being diverted to the spikes which might have let the spikes to stay on the plant for longer duration. Similar results were obtained by Thakur *et al.* (2006) in lilium and Sheetalben *et al.* (2015) in heliconia.

**Table 2: Effect of growth retardants on flowering parameters in crossandra.**

| Treatments | Number of florets per spike | Length of floret (cm) | Longevity of spike in field (days) | Longevity of floret on spike(days) |
|---|---|---|---|---|
| $T_1$ Control (water spray) | 7.18 | 3.14 | 7.01 | 3.00 |
| $T_2$ CCC @ 500 ppm | 7.16 | 2.84 | 7.16 | 3.21 |
| $T_3$ CCC @ 1000 ppm | 7.82 | 3.05 | 7.85 | 3.46 |
| $T_4$ CCC @ 1500 ppm | 8.51 | 3.29 | 8.24 | 3.55 |
| $T_5$ Paclobutrazol @ 500 ppm | 8.15 | 2.93 | 7.12 | 3.14 |
| $T_6$ Paclobutrazol @ 1000 ppm | 6.26 | 2.79 | 6.95 | 2.97 |
| $T_7$ Paclobutrazol @ 1500 ppm | 7.53 | 2.71 | 6.83 | 3.08 |
| $T_8$ Maleic hydrazide @ 200 ppm | 8.62 | 3.34 | 9.13 | 3.90 |
| $T_9$ Maleic hydrazide @ 600 ppm | 8.95 | 3.46 | 9.97 | 4.26 |
| $T_{10}$ Maleic hydrazide @ 1000 ppm | 8.65 | 3.67 | 8.53 | 3.87 |
| **Mean** | **7.88** | **3.12** | **7.88** | **3.44** |
| SE m± | 0.12 | 0.05 | 0.12 | 0.05 |
| CD at 5% | 0.36 | 0.15 | 0.37 | 0.16 |

## CONCLUSIONS

Based on the data, it can be concluded that foliar spraying of MH @ 600 ppm was advantageous for efficiently suppressing vegetative growth while having no negative effect on crossandra blooming and rooting properties.

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