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# Response of crossandra (*Crossandra infundibuliformis* L.) to pruning levels and plant growth regulators

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**Abstract**
The present investigation entitled "Response of crossandra (*Crossandra infundibuliformis*) to pruning levels and plant growth regulators" was conducted at Hi-Tech Nursery, College of Horticulture, D.B.S.K.K.V., Dapoli, Dist. Ratnagiri. during the kharif season (2024-25). The experiment was laid out in Split Plot Design (SPD) with sixteen treatment combinations and three replications. Present investigation revealed that, in different pruning levels $P_1$: Pruning at 20 cm above ground level and in case of plant growth regulators $T_2$: $GA_3$ @ 150 ppm was found significantly superior with respect to plant spread, number of branches, number of leaves, Average leaf area, days to initiation of flower spike, days taken for flower opening, days to 50% flowering, duration of flowering, number of spikes per plant, number of flowers per spike, number of flowers per plant, yield of flowers per plant, yield of flowers per plot, yield of flowers per hectare, number of pickings and shelf life. Conclusively, it can be discerned that intensive pruning levels with use of plant growth regulators *viz*., $P_1T_2$ (Pruning at 20 cm above ground level + $GA_3$ @ 150 ppm) had significant effect on vegetative, flowering and yield parameters of Crossandra (*Crossandra infundibuliformis*).

**Keywords:** Crossandra, pruning, $GA_3$, CCC

## 1. Introduction
Crossandra (*Crossandra infundibuliformis* L.) belongs to the family Acanthaceae. It's also known as "Fire cracker plant," "Tropical flame," or "Kanakambaram". Crossandra is an important commercial flower, mainly grown in India. It is native to India and Sri Lanka. There are different species of crossandra like *Crossandra greenstockki*, *Crossandra horrida*, *Crossandra infilndibuliformis*, *Crossandra longipes*, *Crossandra pungens*, *Crossandra strobilifera*. The species grown for commercial flower production is *Crossandra undulaefolia*. The word crossandra is derived from Greek words 'krossoi' meaning fringe and 'aner' meaning male, thus word crossandra means fringed stamens. Crossandra is an upright, evergreen subshrub characterized by its glossy, wavy-edged leaves. The flowers exhibit 3 to 5 asymmetrical petals and possess a unique shape. Their colours range from the traditional orange to shades of salmon-orange, apricot, coral, red, yellow and even turquoise. It does not have fragrant flowers but it is still desired for its distinct and attractive colour that has attracted the heart of every human being. These flowers are highly valued for their use in garlands, veni, gajra and hair accessories. Although they lack fragrance, crossandra flowers are prized for their striking colours, lightweight nature and excellent longevity. In various informal languages, they are referred to as Priyadarsha (Hindi), Aboli (Konkani/Marathi), Abbolige (Kannada), Kanakambaram (Malayalam), Kanakambaramu (Telugu) and Firecracker (English). (Remya *et al*. 2022) [7].
The application of plant growth regulators (PGRs) and pruning techniques in Crossandra varieties encompasses the assessment of their potential uses in horticulture, floriculture and the conservation of biodiversity. Additional research is required to determine the most effective dosages, application techniques and timing of PGR application and pruning for particular crossandra cultivars and their respective growing environments. The synergistic application of PGRs alongside pruning may be beneficial in enhancing vegetative growth and flowering in crossandra.

## 2. Materials and Methods

The research investigation entitled "Response of crossandra (*Crossandra infundibuliformis* L.) to pruning levels and plant growth regulators" was carried out during July 2024 to November 2024 at College of Horticulture, Dapoli, Dist. Ratnagiri, (M, S.). The experiment was laid out in Split Plot Design (SPD) with sixteen treatment combinations and three replications *viz*, $P_0T_1$ (No pruning + $GA_3$ @ 100 ppm), $P_0T_2$ (No pruning + $GA_3$ @ 150 ppm), $P_0T_3$ (No pruning + CCC @750 ppm), $P_0T_4$ (No pruning + CCC @ 1000 ppm), $P_1T_1$ (Pruning 20 cm above ground level + $GA_3$ @ 100 ppm), $P_1T_2$ (Pruning 20 cm above ground level + $GA_3$ @ 150 ppm), $P_1T_3$ (Pruning 20 cm above ground level + CCC @ 750 ppm), $P_1T_4$ (Pruning 20 cm above ground level + CCC @ 1000 ppm), $P_2T_1$ (Pruning 30 cm above ground level + $GA_3$ @ 100 ppm), $P_2T_2$ (Pruning 30 cm above ground level + $GA_3$ @ 150 ppm), $P_2T_3$ (Pruning 30 cm above ground level + CCC @ 750 ppm), $P_2T_4$ (Pruning 30 cm above ground level + CCC @ 1000 ppm), $P_3T_1$ (Pruning 40 cm above ground level + $GA_3$ @ 100 ppm), $P_3T_2$ (Pruning 40 cm above ground level + $GA_3$ @ 150 ppm), $P_3T_3$ (Pruning 40 cm above ground level + CCC @ 750 ppm), $P_3T_4$ (Pruning 40 cm above ground level + CCC @ 1000 ppm).

## 3. Results and Discussion

### 3.1 Initiation of flower spike (days)

The data gathered on days taken for initiation of flower spike as influenced by different pruning levels and growth regulators is presented in Table 1.

**a) Effect of Pruning levels (P):** In the present experiment, it was inferred that pruning had shown significant effect on initiation of flower spike. The minimum days to initiation of flower spike after pruning (35.30 days) was observed in $P_1$ (Pruning at 20 cm above ground level). Similarly, the maximum days to initiation of flower spike (42.42) was recorded in $P_0$ (No pruning).

From the above investigation, it is observed that pruning has positively influenced flower spike initiation by stimulating new growth and potentially redirecting plant energy towards reproduction. By removing older and less productive growth, pruning can encourage the development of new shoots and buds that are likely to produce flowers and reduced the number of days for initiation of flower spike.

**b) Effect of plant growth regulators (T):** The significantly minimum days to initiation of flower spike (36.43 days) was observed in $T_2$ ($GA_3$ @ 150 ppm). Similarly, the maximum days to initiation of flower spike (41.29 days) was recorded in $T_4$ (CCC @ 1000 ppm). This may be attributed due to the effect of gibberellins, as gibberellins influenced florigen hormone acts as a catalyst for the formation of flowers, leading to early emergence of flower spike. It also promotes flower spike initiation by increasing cell division and elongation in the intercalary meristem, leading to faster internode elongation and reduced vegetative period. This results in earlier flower development and shorter time from planting to flowering. Brooking and Cohen (2002) [2] reported that high gibberellin doses induce more rapid floral initiation than lower doses.

**c) Interaction effect (PxT):** In the interaction studies, it is observed that minimum days to initiation of flower spike (32.13 days) was recorded in treatment combination $P_1T_2$ (Pruning at 20 cm above ground level with $GA_3$ 150 ppm). The maximum days to initiation of flower spike (44.03 days) was recorded in treatment combination $P_0T_4$ (No pruning with CCC @ 1000 ppm).

**Table 1:** Effect of pruning levels and plant growth regulators on days taken for Initiation of flower spike after pruning in crossandra.

| Initiation of flower spike (after pruning) | | | | | |
|---|---|---|---|---|---|
| **Pruning levels** | **PGR concentration** | | | | **Mean** |
| | **$T_1$** | **$T_2$** | **$T_3$** | **$T_4$** | |
| $P_0$ | 42.00 | 40.00 | 43.67 | 44.03 | 42.42 |
| $P_1$ | 34.70 | 32.13 | 35.87 | 38.50 | 35.30 |
| $P_2$ | 35.04 | 35.04 | 39.40 | 40.47 | 37.78 |
| $P_3$ | 39.66 | 38.57 | 40.67 | 42.16 | 40.26 |
| Mean | 38.15 | 36.43 | 39.90 | 41.29 | |
| | S.E m.± | | C.D. at 5% | | Result |
| P | 0.10 | | 0.28 | | SIG |
| T | 0.09 | | 0.26 | | SIG |
| P×T | 0.11 | | 0.30 | | SIG |

### 3.2 Days taken for flower opening

A perusal data in Table 2 clearly showed that the pruning levels and plant growth regulators shows significant variation in days taken for flower opening.

**a) Effect of Pruning levels (P):** The significantly minimum days taken to flower opening (37.34 days) was observed in $P_1$ (Pruning at 20 cm above ground level). Similarly, the maximum days taken to flower opening (44.71 days) was recorded in $P_0$ (No Pruning).

The minimum number of days required for flower initiation could be due to fact that pruning helps to broaden C: N ratio, thus stimulating flowering and increasing vigour of plant as a result of adequate pruning level. The results are in close agreement with findings of Ghulam *et al*. (2004) [6] in Rose. The result obtained are also in agreement with Sushma Lokhande *et al*. (2015) [10] who reported that pruning at 30 cm above ground level resulted in minimum days (64.00 days) for emergence of first flower.

**b) Effect of plant growth regulators (T):** The treatment $T_2$ ($GA_3$ 150 ppm) revealed significantly minimum days taken to flower opening (39.10 days) whereas maximum days taken to flower opening (43.29 days) were observed in treatment $T_4$ (CCC @ 1000 ppm).

This might be attributed to enhance vegetative growth in early phase due to exogenous application of $GA_3$ which would have favoured the increased photosynthesis and $CO_2$ fixation. Further, it would have speed up flower opening by enhancing stem elongation, influencing light requirement and promoting flower bud initiation. This leads to early flowering and longer flower duration. These results are in close confirmatory with findings of Baskaran *et al*. (2007) [1] and Devandanam *et al*. (2007) [4] in Gladiolus.

**c) Interaction effect (PxT)**

In the interaction studies, it is observed that minimum days taken to flower opening (34.13 days) was recorded in treatment combination $P_1T_2$ (Pruning at 20 cm above ground level with $GA_3$ 150 ppm). The maximum days taken to flower opening (45.80 days) was recorded in treatment combination $P_0T_3$ (No pruning with CCC @ 750 ppm).

**Table 2:** Effect of pruning levels and plant growth regulators on days taken for flower opening in crossandra.

| Days taken for flower opening | | | | | |
|---|---|---|---|---|---|
| **Pruning levels** | **PGR concentration** | | | | **Mean** |
| | **$T_1$** | **$T_2$** | **$T_3$** | **$T_4$** | |
| $P_0$ | 45.33 | 43.67 | 45.80 | 44.03 | 44.71 |
| $P_1$ | 36.53 | 34.13 | 38.20 | 40.50 | 37.34 |
| $P_2$ | 38.23 | 37.04 | 40.10 | 43.47 | 39.71 |
| $P_3$ | 42.67 | 41.58 | 44.34 | 45.16 | 43.44 |
| Mean | 40.69 | 39.10 | 42.11 | 43.29 | |
| | S.E m.± | | C.D. at 5% | | Result |
| P | 0.08 | | 0.25 | | SIG |
| T | 0.14 | | 0.39 | | SIG |
| P×T | 0.16 | | 0.45 | | SIG |

### 3.3 Days to 50% flowering

The data on days to 50% flowering in Crossandra as influenced by pruning levels and plant growth regulators is presented in Table 3. It is revealed from the data that the pruning levels, plant growth regulators and their interaction had significant effect on days to 50% flowering.

**a) Effect of Pruning levels (P):** The effect of pruning levels on days to 50% flowering was significant. The data revealed that minimum days to 50% flowering (61.08 days) was detected in P1 (Pruning at 20 cm above ground level). The maximum days to 50% flowering (66.50 days) was recorded in $P_0$ (No pruning).

Pruning can influence the timing of flowering by impacting plant growth and nutrient distribution. By removing unproductive branches or old growth, pruning can redirect resources to flowering buds, potentially accelerating the time to 50% flowering. This can also be due to improved light and air circulation, which can promote healthier growth and flowering.

**b) Effect of plant growth regulators (T):** The $T_2$ ($GA_3$ 150 ppm) revealed significantly minimum days to 50% flowering (61.28 days) whereas maximum days to 50% flowering (66.41 days) was observed in treatment $T_4$ (CCC @ 1000 ppm).

Earliness in attaining 50% flowering was in the plants treated with $GA_3$ treatment as compared to other treatment. It might be due to the fact that $GA_3$ application enhanced the translocation of food for development of floral primordial, which led to early flowering. Furthermore, this may be due to increased photosynthesis and respiration along with enhanced fixation by $GA_3$ that led to flower bud initiation (Sen, 1972) [8].

**Table 3:** Effect of pruning levels and plant growth regulators on days taken to 50% flowering in crossandra.

| Days taken for 50% flowering | | | | | |
|---|---|---|---|---|---|
| **Pruning levels** | **PGR concentration** | | | | **Mean** |
| | **$T_1$** | **$T_2$** | **$T_3$** | **$T_4$** | |
| $P_0$ | 65.50 | 64.07 | 67.03 | 69.38 | 66.50 |
| $P_1$ | 60.70 | 58.13 | 62.14 | 63.36 | 61.08 |
| $P_2$ | 62.23 | 60.37 | 64.40 | 65.73 | 63.18 |
| $P_3$ | 64.66 | 62.57 | 66.34 | 67.16 | 65.18 |
| Mean | 63.27 | 61.28 | 64.98 | 66.41 | |
| | S.E m.± | | C.D. at 5% | | Result |
| P | 0.04 | | 0.13 | | SIG |
| T | 0.07 | | 0.20 | | SIG |
| P×T | 0.08 | | 0.23 | | SIG |

**c) Interaction effect (PxT):** In the interaction studies, it is observed that minimum days to 50% flowering (58.13 days) was recorded in treatment combination $P_1T_2$ (Pruning at 20 cm above ground level with $GA_3$ 150 ppm). The maximum days to 50% flowering (69.38 days) was recorded in treatment combination $P_0T_4$ (No pruning with CCC @ 1000 ppm).

### 3.4 Flowering duration

A perusal of data in Table No. 4 clearly shows that the pruning levels and application of plant growth regulators shows significant variation in duration of flowering in Crossandra.

**a) Effect of Pruning levels (P):** The effect of pruning levels on flowering duration was found to be significant. The data revealed that maximum duration of flowering (66.33 days) was detected in $P_1$ (Pruning at 20 cm above ground level). The minimum duration of flowering (59.25 days) was recorded in $P_0$ (No pruning). Pruning can extend the flowering duration by promoting new growth and flower bud development. Specifically, it can increase the number of flowering shoots and improve flower quality leading to a longer flowering period.

**b) Effect of plant growth regulators (T):** The $T_2$ ($GA_3$ @ 150 ppm) revealed significantly maximum duration of flowering (64.70 days) whereas minimum duration of flowering (59.91 days) was observed in $T_4$ (CCC @ 1000 ppm).

The maximum flower duration might be due to the enhanced vegetative growth in early phase attributed by exogenous application of $GA_3$ would have favored carbohydrate pathway. The longevity of flowering was also observed by Sridhar *et al*. (2013) [9] in *Jasminum auriculatum* and Dalal *et al*. (2009) [3] in chrysanthemum. The similar observation was also recorded by Dhanasekaran (2018) [5] in Jasmine, he concluded that maximum flowering duration was perceived (171.00 days) with $GA_3$ @ 150 ppm followed by $GA_3$ @ 100 ppm (168.5 days).

**Table 4:** Effect of pruning levels and plant growth regulators on flowering duration in crossandra.

| Flowering duration (after spike initiation) | | | | | |
|---|---|---|---|---|---|
| **Pruning levels** | **PGR concentration** | | | | **Mean** |
| | **$T_1$** | **$T_2$** | **$T_3$** | **$T_4$** | |
| $P_0$ | 60.50 | 61.07 | 58.03 | 57.38 | 59.25 |
| $P_1$ | 67.70 | 70.13 | 64.14 | 63.36 | 66.33 |
| $P_2$ | 63.23 | 65.04 | 61.40 | 60.73 | 62.60 |
| $P_3$ | 61.27 | 62.57 | 59.34 | 58.16 | 60.43 |
| Mean | 63.27 | 64.70 | 60.73 | 59.91 | |
| | S.E m.± | | C.D. at 5% | | Result |
| P | 0.04 | | 0.13 | | SIG |
| T | 0.04 | | 0.12 | | SIG |
| P×T | 0.05 | | 0.14 | | SIG |

**c) Interaction effect (PxT):** In the Interaction effect, it is observed that, significantly maximum duration of flowering (70.13 days) was recorded in treatment combination $P_1T_2$ (Pruning at 20 cm above ground level with $GA_3$ 150 ppm). The minimum duration of flowering (57.38 days) was recorded in treatment combination $P_0T_4$ (No Pruning with CCC @ 1000 ppm).

## 4. Conclusion

From the present investigation it could be inferred that pruning of crossandra plants 20 cm above the ground level treated with $GA_3$ @ 150 ppm proved to be superior treatment combination with respect to most of the flowering parameters such as initiation of spike, days taken to flower opening, days to 50% flowering and flowering duration.

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