



Effect of micronutrients on growth of *Crossandra* (*Crossandra infundibuliformis* L.) CV. Delhi

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Abstract

Crossandra is an important traditional flower crop. Which is a herbaceous perennial an erect evergreen, sub shrub, growing upto 1m with glossy appearance. It is comes under the family of Acanthaceae, native to Southern India and Sri Lanka. The present investigation was carried out in the Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalai Nagar during 2019-2020 in Randomized Block Design with eleven treatments and three replications. Eleven treatment combinations were formed for foliar application of micronutrients viz., T₁ – RDF + 0.2% ZnSO₄, T₂ – RDF + 0.2% FeSO₄, T₃ – RDF + 0.2% MgSO₄, T₄ – RDF + 0.2% ZnSO₄ + 0.2% MgSO₄, T₅ – RDF + 0.2% ZnSO₄ + 0.2% FeSO₄, T₆ – RDF + 0.5% ZnSO₄, T₇ - RDF + 0.5% FeSO₄, T₈ – RDF + 0.5% MgSO₄, T₉ – RDF + 0.5% ZnSO₄ + 0.5% MgSO₄, T₁₀ – RDF + 0.5% ZnSO₄ + 0.5% FeSO₄ and T₁₁ - RDF + water spray (Control) were studied on different micronutrient. The effect of treatments was studied based on their biometric observations viz., plant height (cm), number of branches per plant, number of leaves, plant spread per plant (cm²), leaf area (cm²), chlorophyll content (mg g⁻¹) and dry matter production (g/plant). Among the eleven treatments, T₁₀ exhibited maximum value followed by T₅ for all characters except leaf area and chlorophyll content. The maximum leaf area was achieved by T₁₀ followed by T₉, whereas the highest value of chlorophyll content was noticed in T₄ followed T₅.

Keywords: micronutrients, ZN, FE, MG, crssandra

1. Introduction

Crossandra is an important traditional flower crop. Which is a herbaceous perennial an erect evergreen, sub shrub, growing upto 1m with glossy appearance. It is comes under the family of Acanthaceae, native to Southern India and Sri Lanka. It is most often found in south Indian region Malenadu. It is commonly called as 'Firecracker plant' the common refers to the seed pods, which are found after the flower has dried up, and tend to "explode" when near high humidity or rainfall.

The "explosion" releases the seeds into the ground, thereby creating new seedlings. It is popularly known as *kanakambaram* in Tamil, Malayalam and Telugu and *kanakambara* in Kannada. In Maharashtra and Goa it is known as *aboli*. They are the state flower of Goa. It is propagated by seeds or cuttings. This plant has gained the Royal Horticultural Society's Award of Garden Merit. *Crossandra* is the popular flower grown in India due to availability of various varieties suitable for year round cultivation.

Quality is one of the most important parameter in the flower industry which is mainly influenced by application of nutrients. Integrated supply of micro-nutrients with macro-nutrients in adequate amount and suitable proportions is one of the most important factors that control the plant growth in flowering crops. The amounts of micro-nutrients required for proper growth and flowering of *Crossandra*. Micro-

nutrients such as boron (B), iron (Fe), zinc (Zn), copper (Cu), chloride (Cl), manganese (Mn), molybdenum (Mo) and nickel (Ni) are involved in various metabolic processes (Zende, 2008) [8]. Hence, the present investigation was carried out to study the effect of micronutrients on growth of *Crossandra* cv. Delhi.

Materials and Methods

The present investigation on the "Effect of micronutrients on growth of *Crossandra* (*Crossandra infundibuliformis* L.)" was carried out in the Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalai Nagar during 2019-2020 in Randomized Block Design with eleven treatments and three replications. The plants were raised at spacing of 60 x 40 cm. The plants were sprayed with foliar application of eleven treatment combinations of different micronutrients. Twelve plants of each entry in each replication were randomly selected for recording the observations on plant height (cm), number of branches per plant, number of leaves, plant spread per plant (cm²), leaf area (cm²), chlorophyll content (mg g⁻¹) and dry matter production (g/plant).

Preparation of foliar spray solutions

The foliar stock solutions were prepared as per the treatment schedule. Where, Zinc Sulphate, Ferrous sulphate, and Magnesium sulphate are water soluble in nature. 2000mg

(2g) of ZnSO₄, FeSO₄ and MgSO₄ was dissolved in 1 liter of water to get 0.2% (2000ppm) Zinc Sulphate, Ferrous sulphate, and Magnesium sulphate stock solution. 5g of ZnSO₄, FeSO₄ and MgSO₄ was dissolved in 1 liter of water to get 0.5% (5000 ppm) Zinc sulphate, Ferrous sulphate, and Magnesium sulphate stock solution. The required foliar

spray stock solutions were prepared as spray solutions in water as per the treatment requirements. From the stock solution, the required spray solutions are prepared through serial dilution.

The spray solutions were given during the month of November 2019, January, and March, 2020

Table 1: Treatment details

Treatments	Treatments details
T ₁	RDF + 0.2% ZnSO ₄ of foliar spray on 45 th , 90 th , and 125 th DAP
T ₂	RDF + 0.2% FeSO ₄ of foliar spray on 45 th , 90 th , and 125 th DAP
T ₃	RDF + 0.2% MgSO ₄ of foliar spray on 45 th , 90 th , and 125 th DAP
T ₄	RDF + 0.2% ZnSO ₄ + 0.2% MgSO ₄ of foliar spray on 45 th , 90 th , and 125 th DAP
T ₅	RDF + 0.2% ZnSO ₄ + 0.2% FeSO ₄ of foliar spray on 45 th , 90 th , and 125 th DAP
T ₆	RDF + 0.5% ZnSO ₄ of foliar spray on 45 th , 90 th , and 125 th DAP
T ₇	RDF + 0.5% FeSO ₄ of foliar spray on 45 th , 90 th , and 125 th DAP
T ₈	RDF + 0.5% MgSO ₄ of foliar spray on 45 th , 90 th , and 125 th DAP
T ₉	RDF + 0.5% ZnSO ₄ + 0.5% MgSO ₄ of foliar spray on 45 th , 90 th , and 125 th DAP
T ₁₀	RDF + 0.5% ZnSO ₄ + 0.5% FeSO ₄ of foliar spray on 45 th , 90 th , and 125 th DAP
T ₁₁	RDF + water spray (Control)

RDF-Recommended dose of fertilizer-FYM 25 t/ha + 75: 50: 125 Kg/ha (NPK); DAP-days after planting.

Result and Discussion

The results of the present investigation were revealed that foliar spray of zinc, iron and magnesium individually and in combination significantly influenced the plant growth on *Crossandra* cv. Delhi. The various treatments significantly influenced the plant height (Table .2) Among the different treatments, the maximum plant height was recorded in T₁₀ with the values of 27.54, 38.25, 46.35, 52.86, 65.75, and 72.53 cm were taken at 30th, 60th, 90th, 120th, 150th, and 180th DAP respectively, followed by T₅ with the values of 26.52, 36.83, 44.71, 51.04, 63.43, and 70.01cm on 30th, 60th, 90th, 120th, 150th, and 180th DAP respectively. The minimum plant height was observed in T₁₁ (control) with the values 18.24, 25.52, 30.98, 36.32, 44.59, and 49.63cm on 30th, 60th, 90th, 120th, 150th, and 180th DAP respectively. The significant increase in plant height with the best treatment might be due to the fact that, the micronutrients applied at optimum concentration is closely involved in metabolism of RNA and ribosomal content in plant cell which leads to stimulation of carbohydrates, proteins and DNA formation. It also helps in synthesis of tryptophan which acts as a growth promoting substance. Similarly, iron applied with proper concentration acts as an important catalyst in the enzymatic reaction of metabolism. This ultimately would have helped in larger biosynthesis of photo assimilates, thereby enhanced vegetative growth of plant. The results could paint in the same direction of Karuppaiah (2014) [3] in chrysanthemum found that there was a significant difference in plant height.

Among the different treatments, the maximum number of branches (Table 2.) was observed in T₁₀ with the values of 8.45, 14.15, 18.12, 21.25, 27.45, and 35.75 on 30th, 60th, 90th, 120th, 150th, and 180th days after planting (DAP), followed by T₅ with the values of 7.93, 13.58, 17.38, 20.44, 26.39 and 34.41 on 30th, 60th, 90th, 120th, 150th, and 180th DAP. The minimum values of 3.46, 8.93, 11.77, 13.93, 18.12, and 23.45 at 30th, 60th, 90th, 120th, 150th, and 180th DAP were noticed in control (T₁₁). It was interesting to note that higher carbohydrate accumulation in the shoots facilitated by a favorably influenced combination of micronutrient application which might have lead to higher photosynthetic activities and ultimately influences the more number of

branches in *Crossandra*. Senthamizhselvi *et al.* (2000) [6] observed the increased number of primary shoots per plant in *Jasminum sambac* due to the combined effect of micronutrients (zinc and iron).

The maximum numbers of leaves (Table 3.) were recorded in T₁₀ values of 27.69, 46.27, 57.80, 68.98, 75.42, and 136.16 were observed on 30th, 60th, 90th, 120th, 150th, and 180th DAP, followed by T₅ with the values of 28.75, 48.12, 60.05, 72.25, 78.52 and 141.41 on 30th, 60th, 90th, 120th, 150th, and 180th DAP respectively. The minimum number of leaves per plant were observed in control (T₁₁), having the values of 18.68, 30.82, 39.87, 41.58, 50.25 and 87.38 on 30th, 60th, 90th, 120th, 150th, and 180th DAP respectively. The production of leaves per plant was enhanced by the application of Zinc and Iron which activates enzymes that are responsible for the synthesis of certain proteins. The increase in leaf number might be due to continuous availability macro and micronutrients, protein by the application of micronutrients and their involvement in nitrogen metabolism, protein synthesis and hormonal translocation. Hence, micronutrients might have complemented higher leaf production. The findings in the present study were also supported by Ahmad and Qusium (2013) [1] and Kumar *et al.* (2009) [4].

The maximum plant spread per plant (Table 3.) was observed in T₁₀ with the values of 15.75, 25.15, 41.05, 53.25, 67.55 and 78.75 cm² on 30th, 60th, 90th, 120th, 150th, and 180th days DAP respectively, followed by T₅ with the values of 14.93, 24.97, 39.52, 51.31, 65.16 and 75.91 cm² on 30th, 60th, 90th, 120th, 150th, and 180th DAP respectively. The minimum values of 8.14, 19.12, 27.28, 34.94, 44.47 and 51.59 cm² on 30th, 60th, 90th, 120th, 150th, and 180th DAP respectively, were observed in control (T₁₁). In respect to leaf area (Table 4.), the maximum value was observed in T₁₀ with the values of 62.45 cm² which was followed by T₉ with the value of 60.20 cm². The lowest value on leaf area was recorded in T₁₁ (control) with the values of 42.97 cm². This indicates that the abundant of carbohydrate accumulation in leaves facilitates by the combination of micronutrients application might be due to higher photosynthetic activities which results in an increased plant spread and leaf area are more directly related to the

photosynthetic efficiency reported by Hardeep *et al.* (2003) in triploid *Crossandra*, Prabht Kumar and Arora (2000) [5] in African marigold and Karuppiah (2014) in chrysanthemum.

In respect to chlorophyll content (Table 4.), among the various treatment, T₄ recorded the maximum value of 0.65 mg g⁻¹. However, it was closely followed by T₅ with the value of 0.61 mg g⁻¹. The lowest value was recorded in T₃ with the value of 0.36 mg g⁻¹. The significant variation in chlorophyll content might be due to the positive effects of foliar spray and its appropriate combination of magnesium which influence the chlorophyll metabolism and photosynthetic efficiency of the plant as reported by Tara *et al.* (2015) [7] in chrysanthemum. The presence of micronutrients might be very much useful to the crops for more chlorophyll content and higher photosynthetic efficiency. In dry matter production (Table 4.), the result shows the significant difference existed among the treatments against control for this trait. The value for this trait was the highest in T₁₀ with the values of 24.74 g plant⁻¹ followed by T₅ with the values of 30.12 g plant⁻¹. The

lower value was recorded in control 22.56 g plant⁻¹ (T₁₁). The application of ferrous sulphate (0.5%) combination might have favoured the branches, leaf numbers and their development which inturn resulted the more on dry matter production it was also reported by Tara *et al.* 2015) [7].

Conclusion

From the results, it is concluded that foliar spray of T₁₀ (RDF + 0.5% ZnSO₄ + 0.5% FeSO₄ of foliar spray on 45th, 90th, and 125th DAP) exhibited maximum value followed by T₅ (RDF + 0.2% ZnSO₄ + 0.2% FeSO₄ of foliar spray on 45th, 90th, and 125th DAP) for all characters except leaf area and chlorophyll content. The maximum leaf area was achieved by T₁₀ (RDF + 0.2% ZnSO₄ + 0.2% FeSO₄ of foliar spray on 45th, 90th, and 125th DAP) followed by T₉ (RDF + 0.5% ZnSO₄ + 0.5% MgSO₄ of foliar spray on 45th, 90th, and 125th DAP), whereas the highest value of chlorophyll content was noticed in T₄ (RDF + 0.2% ZnSO₄ + 0.2% MgSO₄ of foliar spray on 45th, 90th, and 125th DAP) followed T₅ (RDF + 0.2% ZnSO₄ + 0.2% FeSO₄ of foliar spray on 45th, 90th, and 125th DAP) in *Crossandra* cv. Delhi.

Table 2: Effect of micronutrients on plant height and number of branches per plant of *Crossandra* (*Crossandra infundibuliformis* L.)

Treatments	Plant height (cm)						Number of branches per plant					
	30 Dap	60 Dap	90 Dap	120 Dap	150 Dap	180 Dap	30 Dap	60 Dap	90 Dap	120 Dap	150 Dap	180 Dap
T ₁	22.25	30.21	38.06	43.64	53.89	59.83	5.47	11.21	14.44	17.06	21.97	28.88
T ₂	20.08	28.67	34.47	39.91	49.02	54.68	4.34	9.96	12.94	15.33	19.77	26.11
T ₃	19.57	27.75	33.62	39.06	48.03	53.44	4.22	9.71	12.72	15.04	19.49	25.46
T ₄	24.42	33.57	41.41	47.37	58.67	64.88	6.75	12.42	15.88	18.76	24.14	31.65
T ₅	26.52	36.83	44.71	51.04	63.43	70.01	7.93	13.58	17.38	20.44	26.39	34.41
T ₆	23.33	31.93	39.73	45.51	56.28	62.37	6.06	11.79	15.17	17.92	23.06	30.26
T ₇	21.17	28.67	36.31	41.77	51.48	57.35	4.86	10.59	13.68	16.21	20.89	27.48
T ₈	18.49	26.17	31.94	37.17	45.58	50.87	3.65	9.15	11.98	14.18	18.41	24.07
T ₉	25.46	35.25	43.08	49.21	61.04	67.45	7.35	13.03	16.62	19.62	25.23	33.03
T ₁₀	27.54	38.25	46.35	52.86	65.75	72.53	8.45	14.15	18.12	21.25	27.45	35.75
T ₁₁	18.07	25.52	30.98	36.32	44.59	49.63	3.46	8.93	11.77	13.93	18.12	23.45
SE.d	0.43	0.60	0.74	0.85	1.05	1.17	0.11	0.22	0.28	0.33	0.43	0.56
CD=(P=0.05)	0.91	1.26	1.55	1.73	2.21	2.45	0.23	0.46	0.59	0.70	0.90	1.18

DAP-days after planting.

Table 3. Effect of micronutrients on Number of leaves per plant and plant spread per plant of *Crossandra* (*Crossandra infundibuliformis* L.)

Treatments	Number of leaves per plant						Plant spread per plant (cm ²)					
	30 Dap	60 Dap	90 Dap	120 Dap	150 Dap	180 Dap	30 Dap	60 Dap	90 Dap	120 Dap	150 Dap	180 Dap
T ₁	23.49	38.83	48.76	54.97	62.34	113.93	11.58	21.99	33.52	43.31	55.62	64.34
T ₂	21.37	35.09	44.23	47.47	55.68	102.72	9.84	20.05	30.58	39.32	49.82	58.68
T ₃	20.53	33.84	43.18	46.22	54.48	94.35	9.43	19.63	26.66	38.12	48.22	56.58
T ₄	25.65	44.48	53.3	62.28	68.97	125.04	13.27	23.09	36.53	47.32	60.44	70.12
T ₅	28.75	48.12	60.05	72.25	78.52	141.41	14.93	24.97	39.52	51.31	65.16	75.91
T ₆	24.57	40.63	51.05	58.53	65.66	119.41	12.44	22.97	35.01	45.28	58.04	67.12
T ₇	22.41	37.01	46.36	51.32	59.02	108.61	10.69	21.03	32.01	41.33	53.23	61.48
T ₈	19.48	32.02	40.9	42.66	51.24	88.67	8.56	19.52	28.22	36.14	45.77	53.79
T ₉	26.67	44.37	55.56	65.73	72.21	130.9	14.12	24.07	38.01	49.28	62.81	73.02
T ₁₀	27.69	46.27	57.8	68.98	75.42	136.16	15.75	25.15	41.05	53.25	67.55	78.75
T ₁₁	18.68	30.82	39.87	41.58	50.25	87.38	8.14	19.12	27.28	34.94	44.47	51.59
SE.d	0.45	0.76	0.95	1.08	1.22	2.20	0.23	0.43	0.64	0.85	1.08	1.26
CD=(P=0.05)	0.95	1.60	2.00	2.25	2.55	4.59	0.47	0.89	1.34	1.77	2.26	2.63

DAP-days after planting.

Table 4: Effect of micronutrients on leaf area, chlorophyll content and dry matter production of *Crossandra* (*Crossandra infundibuliformis* L.)

Treatments	Leaf area (cm ²)	Chlorophyll content (mg g ⁻¹)	Dry matter production (g/plant)
T ₁	51.54	0.48	24.74
T ₂	47.17	0.41	21.47
T ₃	46.17	0.36	20.57
T ₄	55.89	0.65	26.91

T ₅	60.20	0.61	29.07
T ₆	53.71	0.51	25.83
T ₇	49.36	0.45	23.65
T ₈	43.99	0.37	21.66
T ₉	58.05	0.56	27.99
T ₁₀	62.45	0.54	30.12
T ₁₁	42.97	0.39	22.56
SE.d	1.02	0.01	0.48
CD=(P=0.05)	2.12	0.02	1.01

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