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Effect of Micronutrients on Flowering and Yield Attributes of Chrysanthemum (*Dendrathemum grandiflora* Tzeuleu) cv.CO 1

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Micronutrients are essential for crop growth and are equally important as primary and secondary nutrients. The Present study was carried out at orchard, Department of Horticulture Faculty of Agriculture, in the year 2010. The experiment was laid out in a Randomised Block Design with seventeen treatments and three replications. The treatment comprised of various combination of micronutrients viz., Zinc sulphate 0.5%, Ferrous sulphate 0.5%, Borax 0.5%, Manganese sulphate 0.5%, Copper sulphate 0.5%, Mixture of all micronutrients 0.5% and micronutrients mixture at 12.5 kg ha^{-1}, two different concentrations with recommended dose 25 t FYM ha^{-1} + RDF of N, P, K and a control at 5 different interval on flowering and yield attributes of chrysanthemum. The results

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revealed that soil application of micronutrients mixture @ 12.5 kg ha^{-1} in split as basal, 25, 50 and 75 DAT were found superior on number of flowers per plant (89.91), flower stalk length (8.92 cm) and flower yield per hectare (21.14 t ha^{-1}).

Keywords: Chrysanthemum; micronutrients; micronutrient mixture; yield.

1. INTRODUCTION

Flowers symbolise purity, beauty, love, passion and tranquillity. Although flowers are mute beauties, they convey the best message of love, joy and affection. They are highly esteemed for their sanctity. Even the birth and death of a human is associated with flowers. Floriculture has become a profitable industry in many parts of the globe. It is a fast growing sector of horticulture in the world growing around 10 - 12 percent per annum. Chrysanthemum is one of the most economically important flower crops cultivated all over the world. It belongs to the family Asteraceae (Compositae), native to the northern hemisphere, chiefly Europe and Asia with a few in other areas. Chrysanthemums are famed for their beautiful colours including red, pink, orange, orange-red, magenta, scarlet colours are contributed by anthocyanins. In cut flower trade chrysanthemum ranks second after rose at the Dutch auctions, which is a good indicator of global trade. In India, it is grown for both domestic and International trade purposes, which plays a key role in the national economy. It is a well known fact that the successful growth and flowering depends upon the application of balanced nutrition. Keeping this view the "Effect of micronutrients on growth, yield and quality of chrysanthemum cv.CO 1" was undertaken. Though, for maximisation of yield and quality of flower crop, various management practices like irrigation, plant density per unit area, season of growing, proper dose of manures and fertilisers, plant protection, etc. Micronutrients are essential for crop growth and are equally important as primary and secondary nutrients. Though their requirement is low, they often make a huge variation in yield and difference in quality of crop produce if there is a deficiency. Micronutrient mixture is involved in all metabolic and cellular functions. Plants differ in their need of micronutrient mixtures like boron, iron, zinc, copper, chlorine, manganese, molybdenum and nickel.

2. METODS

2.1 Location

The experiment was carried out in field conditions. The experimental site is located at about 6 km West of Bay of Bengal at 11°24' North latitude and 79° 41' East longitude and at an altitude of +5.79 M above the mean sea level. The experiment was laid out in Randomised Block Design (RBD) with 3 replications and 17 treatments.

2.2 Treatment

The treatment comprised of various combinations of micronutrients *viz*., Zinc sulphate @ 0.5 %, Ferrous sulphate @ 0.5 %, Borax @ 0.5 %, Manganese sulphate @ 0.5 %, Copper sulphate @ 0.5 %, Mixture of all micronutrients @ 0.5 % and micronutrients mixture at 12.5 kg ha^{-1} on different interval like 25,30, 50, 60 and 75 DAT, soil application and foliar spray. The Chrysanthemum seedlings were transplanted at 45 × 35 cm spacing in ridges and furrows in 2008-2010. Micronutrient mixtures foliar spray was sprayed on the 25, 30, 50, 60 and 75 DAT. The recommended rate dose of fertiliser (125:120:20 NPK kg/ha) were applied as basal and split in the form of Urea, Diammonium Phosphate and Muriate of Potash. At the time of transplanting, half of the dose of N and the full dose of P_2O_5 and K_2O were applied in a circular band. The remaining half dose of nitrogen was applied to the soil 40 days after transplanting. From randomly tagged five plants, were measured. The experimental data were analysed statistically as per the procedure described by Panse and Sukhatme (1978) and wherever the results are found to be significant, the critical differences were arrived at five per cent level to draw statistical conclusions.

3. RESULTS AND DISCUSSION

3.1 Flowering Attributes

Results are presented in Table 1. Among them, treatment T_{17} was found to be the best with the maximum number of flowers per plant (89.91) and maximum flower stalk length (8.92cm), followed by T_{16} which recorded the value of 87.78 and 8.57 respectively. "Micronutrient mixture at 0.25% has exhibited a significantly maximum number of flowers per plant. It might be due to increased concentration of carbohydrates and their translocation from the

leaves to the developing flower buds and production of a higher number of flowers per plant. It was also due to application of zinc which plays a vital role for extended vegetative growth, pollen function, fertilisation, metabolism of RNA, proteins and DNA formation" [1] in African marigold cv. Pusa Narangi Gainda.

"The increase in flowering attributes may be due to the beneficial role of micronutrients in enhancing the translocation of carbohydrates, minerals and amino acids from the site of the synthesis to the storage tissue especially on flowers" as reported by Sha and Karuppaiah [2] in chilli, Patil et al. [3] in sunflower, Balakrishnan et al. [4] in African marigold and Naveen kumar et al. [5] in chrysanthemum. Thirumalmurugan et al. [6] also reported that a significant increase in the maximum number of flowers was noticed under the treatment (Zinc @ 0.5% + Boron @ 0.5%). The maximum flower diameter was increased with Recommended Dose of Fertilizer +Zn+Mn+B Fe, soil application + Zn EDTA +Mn EDTA + B +Fe EDTA (@ 0.4% each as foliar application) in leaves Swetha et al. [7] in gaillardia. Nivya et al. [8] showed that sprayed with $MnSO_4$ 6g/l recorded maximum stalk length, stalk diameter, number of flower buds per plant, bud length, bud diameter and flower size. The findings corroborate the findings of Nishant Kashyap and Tikey, [9] in gladiolus.

3.2 Yield Parameters

Data presented in Fig. 1. Different treatment combinations, T_{17} was found to record the maximum flower yield per hectare (21.14 t ha^{-1}), followed by T_{16} which recorded the value of 20.86 and minimum 15.64 (T_1) t ha^{-1} respectively. Yield is a complex phenomenon which can be controlled both by morphological and physiological parameters and it can also be manipulated by either genetic factor (or) cultural operation. It shows that the soil is deficient in micronutrients and the crop yield can easily be improved by the application of any micronutrients. The favourable positive effect of micronutrients in yield might be attributed by their involvement in the synthesis of chlorophyll, growth promoting substances and acceleration

Table 1. Effect of micronutrients on flower stalk length (cm) and number of flowers per plant of Chrysanthemum

Treatment	Flower stalk length (cm)	Number of flowers per plant
T_1- Control	5.90	63.02
T_2- 25t FYM ha^{-1} + RDF of N, P and K	6.17	65.19
T_3-T_2 + Zinc sulphate @ 0.5 % foliar spray on 30 and 60 DAT	7.82	83.49
T_4-T_2 + Zinc sulphate @ 0.5% foliar spray on 25, 50 and 75 DAT	8.20	85.64
T_5-T_2 + Ferrous sulphate @ 0.5 % foliar spray on 30 and 60 DAT	6.68	71.60
T_6-T_2 + Ferrous sulphate @ 0.5 % foliar spray on 25, 50 and 75 DAT	6.88	74.35
T_7-T_2 + Borax @ 0.5 % foliar spray on 30 and 60 DAT	6.74	72.53
T_8-T_2 + Borax @ 0.5% foliar spray on 25, 50 and 75 DAT	6.97	75.26
T_9-T_2 + Manganese sulphate 0.5 % foliar spray @ 30 and 60 DAT	6.81	73.45
T_{10}-T_2 + Manganese sulphate 0.5% foliar spray @ 25, 50 and 75 DAT	7.05	76.19
T_{11}-T_2 + Copper sulphate 0.5% foliar spray @ 30 and 60 DAT	6.24	67.32
T_{12}-T_2 + Copper sulphate 0.5% foliar spray @ 25, 50 and 75 DAT	6.47	69.47
T_{13}-T_2 + Mixture of all micronutrients @ 0.5% foliar spray on 30 and 60 DAT	7.14	77.09
T_{14}-T_2 + Mixture of all micronutrients @ 0.5% foliar spray on 25, 50 and 75 DAT	7.39	79.22
T_{15}-T_2 + Soil application of micronutrients mixture @ 12.5 kg ha^{-1} as basal	7.61	81.36
T_{16}-T_2 + Soil application of micronutrients mixture @ 12.5 kg ha^{-1} in split as basal, 30 and 60 DAT	8.57	87.78
T_{17}-T_2 + Soil application of micronutrients mixture @ 12.5 kg ha^{-1} in split as basal, 25, 50 and 75 DAT	8.92	89.91
S. Ed	0.17	1.06
CD (p = 0.05)	0.35	2.13

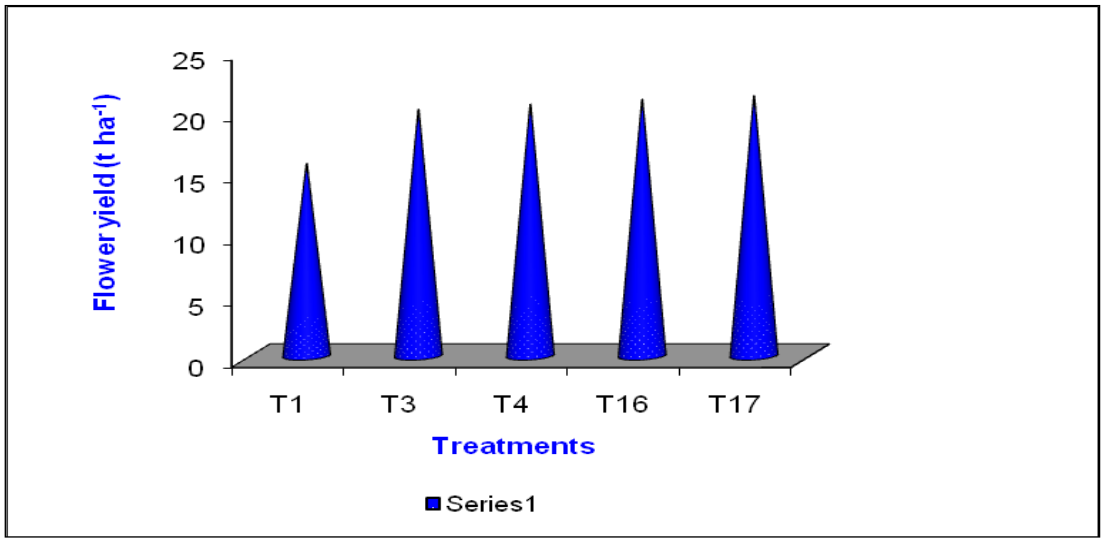

Fig. 1. Effect of micronutrients on flower yield (t ha^{-1}) of chrysanthemum

in synthesis and mobility of photosynthates, minerals and amino acids from the source to sink that enhances the per hectare yield. Selvi [10] also observed the same trend of results for flower yield with 'stanes' micro food containing Zn, Cu, Fe, Mn, B and Mo in tomato. The similar findings were reported by Gurav et al. [11] in flower crops, Sha and Karuppaiah [2] in chilli and Balakrishnan et al. [4] in African marigold. Further, Selvi Ranganthan and Raniperumal [12] observed that the reason for the better yield might be due to the stimulation of plant growth especially root system by the micronutrients with consequent health in greater absorption and translocation of nutrients and due to the favourable and additive effect of this micronutrients which in turn resulted in the increased yield. Similar findings were recorded by Ashok et al. (2023) in African marigold cv. Pusa Narangi Gainda. "The highest number of spikes per clump was obtained when bulbs were treated with spraying $ZnSO_4$ @ 0.5 % and $FeSO_4$ 0.2 %. This might be due to the stimulating the conversion of storage polymers (polysaccharides, proteins and fats) into sucrose or mobile amino acids to facilitate their translocation via phloem into and throughout the young root and shoot system and thus influencing spike production" Ganesh et al. [13]. "A maximum number of florets per spike was noted when all the three micronutrients were applied in combination ($FeSO4.7H_2O$, H_3BO_3 and $ZnSO_4.7H_2O$ (all at 2% level) and this number was significantly higher than that for all the other micronutrients treatments" [14]. "Weight of flower and yield of flower per ha was reported significantly maximum with foliar application of urea 2%" [15]. "Foliar application of $ZnSO_4$ (0.75%) + Boric acid (0.5%) + $FeSO_4$ (1.5%) + $MgSO_4$ (0.5%) + $MnSO_4$ (1%) + $CuSO_4$ (0.3%) at 210 days after pruning. Number of flowers per plant (116.98) and total yield per plant (0.73kg) was significantly increased with the application of $ZnSO_4$ (0.75%) + Boric acid (0.5%) + $FeSO_4$ (1.5%) + $MgSO_4$ (0.5%) + $MnSO_4$ (1%) + $CuSO_4$ (0.3%) at 210 days after pruning" [16] in floribunda rose.

4. CONCLUSION

Based on the field investigation, it is concluded that the treatment combination of T_{17} (soil application of micronutrients mixture @ 12.5 kg ha^{-1} in split as basal, 25, 50 and 75 DAT) was found to be the best for the effective open field cultivation of chrysanthemum under coastal ecosystem at commercial level.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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