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Response of copper on growth and yield of tomato cv. pkm-1 in coastal soil

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Abstract
A Field experiment was conducted in a sandy loam soil to find out the effect of copper on the growth, yield and uptake of nutrients by tomato (Var. PKM-1). Ten treatments were applied. The result of the experiment revealed that soil application of CuSO4 @ 12.5 kg ha^{-1} and foliar spray 0.1% Cu (T_4) enhanced the yield of tomato over control. The highest uptake of N and K was recorded in the treatment receiving soil application of $CuSO_4$ @ 12.5 kg ha^{-1} along with foliar application of 0.2% Cu on 30 and 60 DAT (T_8).

Keywords: tomato, copper, growth, yield and uptake

Introduction
Intensive cropping, losses of micronutrients through leaching, scarcity of FYM, increasing purity of chemical fertilizer and several other factors are contributing towards accelerated exhaustion of available micronutrients in the soil; considering the entire state of Tamil Nadu, copper can be seen deficient in 30% of soils (Anonymous, 1990) [1]. An important part of the history of plant culture focuses on the problems of copper element and the importance has been well understood at least in the major food and fruit crops but information on vegetable crops is lacking. In the present study attempts have been made to evaluate the effect of copper on yield, growth and uptake of nutrients by tomato.

Materials and Methods
A field experiment was conducted on sandy loam (*Typic ustifluvents*) at Vallampadugai to study the effect of application on tomato (cv. PKM-1).The various treatments involved in the present study were T_1 - Control, T_2 - Soil application $CuSO_4$ @ 12.5 kg ha^{-1}, T_3 - Soil application of $CuSO_4$ @ 12.5 kg ha-^{1} + Foliar spray 0.1% Cu 30 DAT, T_4 - Soil application of $CuSO_4$ @ 12.5 kg ha^{-1} + Foliar spray 0.1% Cu 30 DAT and 60 DAT, T_5 - Foliar spray 0.1% Cu 30 DAT, T_6 - Foliar spray 0.1% Cu 30 DAT and 60 DAT T_7 - Soil application $CuSO_4$ @ 12.5 kg ha^{-1} + Foliar spray 0.2% Cu 30 DAT T_8 - Soil application $CuSO_4$ @1 2.5 kg ha^{-1} + Foliar spray 0.2% Cu 30 DAT and 60 DAT T_9 - Foliar spray 0.2% Cu 30 DAT T_{10} - Foliar spray 0.2% Cu 30 and 60 DAT. These treatments were triplicated in RBD. The soil were analyzed as pH 7.6, EC 0.3 dSm^{-1}, organic carbon 0.5 g kg^{-1}CEC 16.4 c.mol (p^+) (kg^{-1})and low in copper (0.71 mg kg^{-1}). Recommended dose of N, P_2O_5 and K_2O were applied through urea, DAP and MOP respectively. The fruits were harvested in a staggered manner as and when they were ready for harvest. The fruit yield per plot was recorded at each time of the harvest and pooled together and expressed as kg ha^{-1}. The plants were removed from each plot with utmost care on 90 DAT. The plant samples were thoroughly washed with distilled water and then oven dried in a hot air oven at 70□C to obtain a constant weight. The results expressed kg ha^{-1}. Nitrogen in plant samples was determined by microkjeldahl method (AOAC. 1970), total P was estimated in triple acid digest by Vanadomolybdate yellow colour method. The extract was used for the determination of K by Flame photometer and copper by Atomic Absorption Spectrophotometer.

Results and Discussion
a) Plant height (Table 1)
There was significant increase due to treatments with copper application through soil, foliar and in combination of both. The treatment T_4 recorded the highest plant height of 95 cm followed by treatment T_3 which recorded 94 cm). The perceptible increase in height of tomato plants was in agreement with the findings of Burca *et al.* (2003) [3].

b) Fruit yield (Table 1)
The treatment (T_4) Soil application of $CuSO_4$ @ 12.5 kg ha^{-1} and foliar spray 0.1% of Cu 30 DAT recoded highest fruit yield of 21.94 t ha^{-1}. This was followed by soil application T_7 (21. 5 t ha^{-1}), T_3 (21 t ha^{-1}), T_2 (20.56 t ha^{-1}), T_8 (20.51 t ha^{-1}) and T_5 (17.46 t ha^{-1}) were on par with each other. Similar findings were reported by Shkvaruk and Nikolaichuk (2003) [4] and Tsyplenkov and Formin (2004) [5].

Table 1: Effect of copper treatments on plant height and fruit yield of tomato

Treatments	Plant height (cm)	Yield (t ha^{-1})
T_1	75	14.49
T_2	86	20.56
T_3	94	21.00
T_4	95	21.94
T_5	89.2	17.46
T_6	89.75	15.89
T_7	89.12	21.5
T_8	86.12	20.51
T_9	85.0	15.00
T_{10}	76.25	15.15
CD (p=0.05)	0.652	0.342

c) NPK Uptake by tomato (Table 2)
Increasing levels of copper by soil application of $CuSO_4$ 12.5

kg ha^{-1} and foliar spray @ 0.2% Cu 30 and 60 DAT (T_8) recorded the highest N uptake of 52.65 kg ha^{-1} followed by the treatments T_4 (50.91 kg ha^{-1}), T_7 (50.01 kg ha^{-1}) and T_3 (48.72 kg ha^{-1}) respectively.

The P uptake of tomato plant were found to be the highest in treatment T_9 (4.74 kg ha^{-1}) which was on par with the treatments T_2, T_3, T_4 and T_5 (4.33, 4.66, 4.56 and 4.33 kg ha^{-1}) respectively.

The K uptake of tomato plant was also found to be the highest intreatment T_8 (32.75 kg ha^{-1}) followed by the treatments T_7 (31.18 kg ha^{-1}), T_3 (29.98 kg ha^{-1}) and T_2 (28.06 kg ha^{-1}) respectively.

Table 2: Effect of copper treatments on NPK uptake in tomato plant

Treatments	N uptake (kg ha^{-1})	P uptake (kg ha^{-1})	K uptake (kg ha^{-1})
T_1	26.22	3.68	16.24
T_2	44.99	4.33	28.06
T_3	48.72	4.46	29.98
T_4	50.91	4.56	31.06
T_5	39.93	4.33	24.77
T_6	42.37	4.05	26.39
T_7	50.01	4.20	31.18
T_8	52.65	3.78	32.75
T_9	41.24	4.74	25.75
T_{10}	44.18	4.23	27.25
CD (p=0.05)	1.073	0.431	0.795

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