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Effect of Fe-EDTA on growth, yield and quality of red chilli (*Capsicum annuum* L.)

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ABSTRACT

An experiment was carried out to study the effect of soil and foliar application of Fe-EDTA on yield and quality of chilli (Cv. Byadgi dabbi) in a calcareous Vertisols at UAS, Dharwad during 2006. Soil application of Fe-EDTA equivalent to $FeSO_4$ at 20 kgha^{-1} + 0.5 % Fe-EDTA foliar spray at 50 DAT was found most effective and recorded significantly higher plant height (83.12 cm), number of branches (17.92), dry matter production(114.32g plant^{-1}), dry fruit yield (10.5 q ha^{-1}) and ascorbic acid content (178.90 mg 100g^{-1}). But soil application of Fe-EDTA equivalent to $FeSO_4$ at 20 kgha^{-1} + 0.5 % Fe-EDTA foliar spray at 50 and 90 DAT was recorded highest colour value (228.7 ASTA units) and oleoresin content (16.76 %). Where as lowest plant height (70.98 cm), number of branches (12.91), dry matter production (73.13 g plant^{-1}) dry fruit yield (7.65 q ha^{-1}), ascorbic acid content (127.6 mg 100g^{-1}), colour value (163.1 ASTA units) and oleoresin content (13.03 %) were recorded with application of recommended dose of fertilizers.

Key words : Iron-EDTA, Byadgi dabbi, Colour value, Ascorbic acid, Oleoresin, Vertisol

INTRODUCTION

Chilli (*Capsicum annuum* L.) is an important spice cum vegetable crop grown in medium black and deep black calcareous vertisols in Northern Karnataka. In these soils one of the the major problems is, availability of iron is low and it is severe in Karnataka state. In order to correct the deficiency of iron the common practice is to apply Fe either through soil or foliar application. In this respect, if iron is applied in the form of chelate (Fe-EDTA) the efficiency will be high and response to applied iron is quick. It is essential to supply the iron either through soil or foliar spray for obtaining better productivity as well as quality. The price of red chillies is mainly based on the colour value. Wrinkled shining blood red coloured fruits fetch highest price. Among the micronutrients iron appears to play an importent role in the synthesis of red colour in chillies (Malawadi *et al*., 2004). Further, iron content of leaves and stems is closely related to colour value of red chillies (Martinez *et al*., 1990). Since chilli is being extensively cultivated in calcareous Vertisols in northern Karnataka, it is likely to be deficient in these soils. Information pertaining to the use of Iron–Chelate (Fe-EDTA) as source of iron in improving the quality attributes of chillies grown in calcareous Vertisol is lacking.

MATERIALS AND METHODS

The experiment was carried out during *Kharif* 2006 in a calcareous Vertisols at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad (Karnataka). The soil pH was 7.40, electrical conductivity 0.42 dSm^{-1}, organic carbon 6.10g kg^{-1}, free lime content 9.80%, available iron 3.10 mg kg^{-1}, available nitrogen 350.5 kg ha^{-1}, available phosphorus 27.2 kg ha^{-1}, available potassium 410.9 kg ha^{-1} and available sulphur 24.4 ppm. The amorphous form of Fe-EDTA containing 12% iron was used as source of iron. The experiment consisted of twelve treatments replicated thrice and laid out in a Randomized Complete Block Design (RCBD). The Fe-EDTA was applied to soil and as foliar spray. Soil application was done at planting with two levels and foliar application was done at different crop growth stags. The recommended dose of N, P and K were applied @ 100:50:50 kgha^{-1}as basal dose through urea, diammonium phosphate and muriate of potash, respectively. The variety of chilli used was Byadgi dabbi. All the cultural practices were followed as per the package of practices of UAS, Dharwad.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been presented under following heads:

Growth and yield:

Soil application of Fe-EDTA resulted in significantly higher growth and yield compared to control (Table 1). Soil application of Fe-EDTA equivalent to $FeSO_4$ at 20 kg ha^{-1} + 0.5% Fe-EDTA as foliar spray at 50 days after transplanting (DAT) recorded as significantly higher plant

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Table 1 : Effect of method and time of application of different levels of Fe-EDTA on growth and yield of red chilli

Treatments	Plant height (cm)	No. of branches	Dry matter yield (g plant^{-1})	Dry fruit yield (q ha^{-1})
T_1: Control (only RDF)	70.98	12.91	73.13	7.65
T_2: FYM at 10 t ha^{-1}	71.10	13.81	74.72	7.88
T_3: Water spray at 50 and 90 DAT	72.22	14.08	76.18	7.90
T_4: 0.5% Fe-EDTA foliar spray at 50 DAT	73.52	13.97	85.92	9.00
T_5: 0.5% Fe-EDTA foliar spray at 90 DAT	72.35	14.04	84.37	8.50
T_6: 0.5% Fe-EDTA foliar spray at 50 and 90 DAT	74.65	14.12	88.32	8.65
T_7: Fe-EDTA soil application equivalent to $FeSO_4$ at 10 kg ha^{-1} + 0.5% Fe- EDTA foliar spray at 50 DAT	77.50	14.85	99.56	9.90
T_8: Fe-EDTA soil application equivalent to $FeSO_4$ at 20 kg ha^{-1} + 0.5% Fe- EDTA foliar spray at 50 DAT	83.12	17.92	114.3	10.5
T_9: Fe-EDTA soil application equivalent to $FeSO_4$ at 10 kg ha^{-1} + 0.5% Fe-EDTA foliar spray at 90 DAT	76.52	14.52	90.51	9.54
T_{10}: Fe-EDTA soil application equivalent to $FeSO_4$ at 20 kg ha^{-1} + 0.5% Fe-EDTA foliar spray at 90 DAT	80.82	15.73	105.9	10.3
T_{11}: Fe-EDTA soil application equivalent to $FeSO_4$ at 10 kg ha^{-1} + 0.5% Fe-EDTA foliar spray at 50 and 90 DAT	80.02	14.63	98.84	9.70
T_{12}: Fe-EDTA soil application equivalent to $FeSO_4$ at 20 kg ha^{-1} + 0.5% Fe-EDTA foliar spray at 50 and 90 DAT	82.55	16.27	111.2	10.4
S.E.±	4.560	0.811	5.92	0.43
C.D. (P = 0.05)	NS	2.381	17.38	1.28

Note: EDTA- Ethylene Di amine tetra acetic acid, DAT- Days after transplanting, RDF- Recommended dose of fertilizers, FYM- Farm yard manure

Table 2 : Effect of methods and time of application of different levels of Fe-EDTA on quality of chilli

Treatments	Ascorbic acid (mg 100g^{-1})	Colour value (ASTA units)	Oleoresin (%)
T_1: Control (only RDF)	127.6	163.1	13.03
T_2: FYM at 10 t ha^{-1}	131.3	170.9	13.34
T_3: Water spray at 50 and 90 DAT	142.0	175.3	13.72
T_4: 0.5% Fe-EDTA foliar spray at 50 DAT	152.0	178.8	14.06
T_5: 0.5% Fe-EDTA foliar spray at 90 DAT	141.5	177.6	13.54
T_6: 0.5% Fe-EDTA foliar spray at 50 and 90 DAT	149.7	179.4	14.35
T_7: Fe-EDTA soil application equivalent to $FeSO_4$ at 10 kg ha^{-1} + 0.5% Fe-EDTA foliar spray at 50 DAT	160.2	208.4	15.42
T_8: Fe-EDTA soil application equivalent to $FeSO_4$ at 20 kg ha^{-1} + 0.5% Fe-EDTA foliar spray at 50 DAT	178.9	223.4	16.42
T_9: Fe-EDTA soil application equivalent to $FeSO_4$ at 10 kg ha^{-1} + 0.5% Fe-EDTA foliar spray at 90 DAT	155.8	194.6	15.03
T_{10}: Fe-EDTA soil application equivalent to $FeSO_4$ at 20 kg ha^{-1} + 0.5% Fe-EDTA foliar spray at 90 DAT	162.2	211.6	16.34
T_{11}: Fe-EDTA soil application equivalent to $FeSO_4$ at 10 kg ha^{-1} + 0.5% Fe-EDTA foliar spray at 50 and 90 DAT	158.5	207.7	16.03
T_{12}: Fe-EDTA soil application equivalent to $FeSO_4$ at 20 kg ha^{-1} + 0.5% Fe-EDTA foliar spray at 50 and 90 DAT	166.7	228.7	16.76
S.E.±	7.93	9.41	0.49
C.D. (P = 0.05)	23.27	27.60	1.43

Note: EDTA- Ethylene Di amine tetra acetic acid, DAT- Days after transplanting, RDF- Recommended dose of fertilizers, FYM- Farm yard manure, ASTA-American science trade association

height (83.12cm), number of branches (17.92), dry matter production (114.3g plant^{-1}) and dry fruit yield (10.5 q ha^{-1}) followed by Fe-EDTA as soil application equivalent to $FeSO_4$ at 20 kg ha^{-1} + 0.5% Fe-EDTA as foliar spray at 50 and 90 DAT (82.55 cm, 16.27, 111.2 g plant^{-1} and 10.4 q ha^{-1}, respectively). Where as, application of recommended dose of fertilizers (RDF) recorded lowest plant height (70.98cm), number of branches (12.91), dry matter production (73.13 g plant^{-1}) and dry fruit yield (7.65qha^{-1}). The increased growth and yield of chillies might be attributed to role of iron in chlorophyll synthesis, which enhances the photosynthetic activity and increased vegetative growth leading to higher dry matter accumulation, fruit development and yield. (Dongre *et al.,* 2000 and Kumbhar and Deshmukh 1993).

Quality attributes:

Maximum ascorbic acid content (178.9 mg100g^{-1}) was recorded in the treatment (T_8) that received Fe-EDTA as soil application equivalent to $FeSO_4$ at 20 kg ha^{-1} + 0.5% Fe-EDTA as foliar spray at 50 DAT followed by Fe-EDTA as soil application equivalent to $FeSO_4$ at 20 kg ha^{-1} + 0.5% Fe-EDTA foliar spray at 50 and 90 DAT (166.7 mg 100g^{-1}). Improvement in ascorbic acid content might be due to increase in the activity of ascorbic acid oxidase enzyme causing the marked improvement in vitamin C content as iron is an activator of many enzymes (Batra *et al.,* 2006). Similarly higher colour value (228.7 ASTA units) and oleoresin content (16.76%) were recorded in the soil application of Fe-EDTA equivalent to $FeSO_4$ at 20 kg ha^{-1} + 0.5% Fe-EDTA as foliar spray at 50 and 90 DAT followed by Fe-EDTA as soil application equivalent to $FeSO_4$ at 20 kg ha^{-1} + 0.5% Fe-EDTA foliar spray at 50 DAT (223.4 ASTA units and 16.42%). Red colour in chilli fruits is mainly due to capsanthin and capsorubins which constitute 60-70 per cent of â- carotene. These capsanthin and capsorubins are made up of porpyrin molecules (haematin, ferrichrome and leghaemoglobin) and iron is a structural component of all these molecules. Hence, role of iron in influencing colour value of fruits is quite evident (Martinez *et al.,* 1990 and Cazi, 1961). Further there exit a synergistic relationship between K and Fe. Application of Fe-EDTA might have increased K uptake leading to increased colour value. But in case of oleoresin, greater synthesis and translocation of ferrodoxin photosynthetes to developing fruits, which are the iron-sulfur proteins that constitute chilli oleoresin. The greater uptake of K has played greater role in oleoresin synthesis (Malawadi *et al.,* 2004).

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