

## Micronutrient status of rainfed red soils (*Entisol* and *Alfisol*) of Dharmapuri district, Tamil Nadu

P. BALASUBRAMANIAM, A.K. MANI AND V.P. DURAISAMI

*Regional Research Station, Tamil Nadu Agricultural University, Paiyur-635 112, Tamil Nadu.*

**Abstract:** The red soil areas of Dharmapuri district belonging to the order Entisol and Alfisol were studied for the availability of cationic micronutrients viz., iron, manganese, zinc and copper and their correlation with other important soil properties. The study area showed sufficiency of iron and manganese. The deficiency of zinc was observed in some pockets of Vannapatti and Thoppur soil series. Occurrence of copper deficiency was wide spread in rainfed area irrespective of different soil series.

**Keywords:** *Cationic micronutrients, rainfed red soils*

### Introduction

In Dharmapuri district, the soil series viz. Vannapatti, Hosur, Kelamangalam, Krishnagiri, Thoppur and Salem were found to occupy 3.77, 1.05, 0.14, 0.24, 0.21 and 0.18 lakh hectares accounting for a total of 5.59 lakh ha out of 9.82 lakh ha of total geographical area. About 1.11 lakh ha is irrigated and remaining area under rainfed. The study area falls under the North Western zone of Tamil Nadu where, ragi, samai, groundnut and horse gram are grown under rainfed conditions. Delineation of soils for micronutrient status is not only useful in forecasting the micronutrient deficient area but also helpful in utilizing the data for planning the production and distribution of fertilizers containing micronutrients. No systematic study has been undertaken in this zone, which led to study of DTPA extractable micronutrient status of red soil.

### Materials and Methods

A total of one hundred and thirty seven surface soil samples were collected from the rainfed red soil area of Dharmapuri district (North-Western Zone, Tamil Nadu) representing six soil series belonging to Entisol and Alfisol. The details of samples collected are given in

Table 2. The soil samples were processed and analysed for the physicochemical properties following standard procedures (Jackson, 1973) and presented in Table 1. The DTPA extractable micronutrients were analysed according to the procedures outlined by Lindsay and Norvell (1978). The critical level (CL) used to delineate the deficiency and sufficiency level for different micronutrients were 3.7 ppm for iron, 2.0 ppm for manganese, 1.2 ppm for zinc and copper. Simple correlation was worked out between important soil properties and micronutrients status.

### Results and Discussion

#### *Available Iron :*

The mean DTPA extractable iron content among the different soil series ranged from 3.75 to 43.53 ppm. Although there was a wide range, the values fall above the critical level. However, the range and mean values varied with the soil series, the lower being in Thoppur (5.89 to 20.18 ppm with a mean of 9.37 ppm) and Vannapatti (3.75 to 27.0 ppm with a mean of 9.69 ppm), whereas higher range of 14.76 to 43.53 ppm recorded in Kelamangalam with a mean of 24.7 ppm. The DTPA-Fe had negative correlation with soil

**Table 1.** Important physico-chemical properties of red soils in rainfed areas of Dharmapuri district of Tamil Nadu.

S.No.	Soil Properties	Range	Mean
1	Sand (%)	52.5-88.5	72.40
2	Slit (%)	2.3-21.3	12.47
3	Clay (%)	5.2-28.7	13.32
4	pH(1.2)	6.3-8.7	7.13
5	EC (1:2) dSm <sup>-1</sup>	0.01-0.44	0.119
6	CEC (Cmole (P) kg <sup>-1</sup> )	1.2-17.4	6.70
7	Organic Carbon (%)	0.025-0.579	0.224
8	Available N (KMnO <sub>4</sub> ) (ppm)	22.4-138.6	89.72
9	Available P (Olsen) (ppm)	0.2-28.0	5.82
10	Available K (NH <sub>4</sub> OAc) (ppm)	12.5-157.5	64.65
11	Available Ca (NH <sub>4</sub> OAc) (ppm)	88-7840	1257.50
12	Available Mg (NH <sub>4</sub> OAc) (ppm)	60-3888	444.30
13	Available S (0.15% CaCl <sub>2</sub> ) (ppm)	2.0-26.1	11.80

reaction (pH), electrical conductivity (EC), organic carbon (OC) and calcium (Ca) where as positive correlation was observed with sulphur (S). Negative relationship with pH was also observed by Gowrishankar and Murugappan (1995). The Positive correlation with sulphur might be due to the formation of iron sulphate under conditions of low pH, which may bring more iron to the soil solution.

#### Available Manganese

Available Mn in red soils of rainfed area had sufficient quantum, in the area studied, with Mn levels more than the critical limit. However, among the different soil series, Vannapatti recorded wide range of 2.92 to 43.68 ppm while a narrow range of 21.42 to 31.94 ppm was recorded in Salem series. Manganese exhibited positive correlation with cation exchange capacity (CEC) and nitrogen (N) and negative relationship existed with soil reaction (pH) and potassium (K), which might be due to retention of Mn in exchangeable form led to decreased K in the exchange site. The positive relationship of Mn and CEC was

observed by Gowrishankar and Murugappan (1995) lend support to the present work.

#### Available Zinc

Among the different soil series studied, 8.08 and 16.67 per cent area under Vannapatti and Thoppur series were below the critical limit respectively. The highest mean level of Zn was recorded in Kelamangalam series (9.59 ppm). Zinc was positively related with CEC and S and negative correlation existed with OC, P and pH, which might be due to increased Zn level under low P conditions. The negative correlation with OC was in contrast to the report of Gowrishankar and Murugappan (1995) and might be due to the soil studied in the present investigation has poor organic matter.

#### Available Copper

Among the different cationic micronutrients Cu alone was in the deficiency level irrespective of the series. However, among the six soil series studied, higher per cent of deficiency occurred in Thopper series (66.67%) followed by Vannapatti (53.54%) and Krishnagiri (26.67%) series. Copper had showed positive correlation

Table 2a. DTPA extractable iron and manganese status of red soils in rainfed areas of Dharmapuri district.

Name of the soil series	Taxonomic class	No. of samples	Iron (ppm)			Manganese (ppm)				
			Range	Mean	Percentage of samples	Range	Mean	Percentage of samples		
					<C.L.	>C.L.	<C.L.	>C.L.		
Vannapatti	Typic Ustorthent	99	3.75-27.00	9.69	Nil	100.00	2.92-43.68	16.47	Nil	100
Hosur	Ultic Haplustalf	14	5.38-32.23	17.17	Nil	100.00	14.75-32.72	22.84	Nil	100
Kelamangalam	Typic Ustafluent	6	14.76-43.53	24.57	Nil	100.00	14.0-24.09	19.64	Nil	100
Krishnagiri	Typic Haplustalf	7	7.68-20.84	14.17	Nil	100.00	11.68-23.90	17.03	Nil	100
Thoppur	Udic Haplustalf	6	5.89-20.18	9.37	Nil	100.00	9.92-35.20	15.89	Nil	100
Salem	Typic Rhodustalf	5	12.62-20.92	15.83	Nil	100.00	21.42-31.94	27.19	Nil	100
SD				5.61				4.43		

C.L.: Critical level

Table 2b. DTPA extractable zinc and copper status of red soils in rainfed areas of Dharmapuri district.

Name of the soil series	Taxonomic class	No. of samples	Zinc (ppm)			Copper (ppm)				
			Range	Mean	Percentage of samples	Range	Mean	Percentage of samples		
					<C.L.	>C.L.	<C.L.	>C.L.		
Vannapatti	Typic Ustorthent	99	0.86-17.91	3.97	8.08	91.82	0.16-6.51	1.42	53.64	46.46
Hosur	Ultic Haplustalf	14	1.21-15.38	7.49	Nil	100.00	0.96-6.22	2.23	35.71	64.29
Kelamangalam	Typic Ustafluent	6	4.69-13.71	9.69	Nil	100.00	1.11-7.07	8.83	28.67	71.43
Krishnagiri	Typic Haplustalf	7	1.45-14.44	6.34	Nil	100.00	0.55-2.77	1.55	16.67	83.33
Thoppur	Udic Haplustalf	6	1.12-2.83	2.09	16.67	83.33	0.66-2.09	1.27	66.67	33.33
Salem	Typic Rhodustalf	6	1.77-16.54	5.59	Nil	100.00	0.55-6.62	3.36	20.00	80.00
SD	2.83			1.08						

C.L.: Critical level

