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AVAILABLE MICRONUTRIENTS IN SOILS OF VIRUDHUNAGAR AND VELLORE DISTRICTS OF TAMIL NADU

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ABSTRACT

Surface soil samples were collected from cultivated lands of Virudhunagar and Vellore districts. Out of 456 soil samples analysed, Zn deficiency was observed in 41.0-64.5 per cent of the samples in various taluks of Virudhunagar district. While in five taluks of Vellore district (258), Zn deficiency was noticed from 42.0 to 82.0 per cent of the samples analysed. On an average, 1.0 and 7.2 of Cu deficiency and 1.6 and 0.8 per cent of Fe deficiency were observed in Virudhunagar and Vellore districts respectively. Manganese content was well above critical limit in all the soil samples of both the districts.

Delineation of regions for micronutrient deficiencies and toxicity is very important to have need and location based application of micronutrients for amelioration of specific nutrient deficiency in the soil and plant so as to enhance the crop production. Keeping the above points in view, a survey was undertaken to collect surface soil samples from cultivable areas of Virudhunagar and Vellore districts.

A total of 456 and 258 surface (0-15 cm deep) soil samples were collected from cultivable areas of Virudhunagar and Vellore districts respectively. These samples were processed and analysed for pH, EC and available Zn, Cu, Fe and Mn status using DTPA as extractant (Lindsay and Norvell, 1978).

Virudhunagar district : The analytical data of Zn, Cu, Mn and Fe were categorised as sufficient or deficient based on the critical level fixed for the soils of Tamil Nadu. The critical levels fixed in Tamil Nadu are as follows; Zn-1.2 ppm, Cu-0.6 ppm, Mn-2.0 ppm and Fe-3.7 ppm. The analytical data pertaining to the soils of this district is furnished in Table 1. In general, soils were slightly acidic to alkaline (6.1-8.8) and had low salt content (0.1-0.4 d Sm^{-1}). Analytical data of micronutrients revealed that Aruppukottai taluk had deficiency of Zn in 54 per cent of the samples; Rajapalayam taluk 64.5 per cent, Sattur 50 per cent and Srivilliputhur 47.0 per cent. The district average was 50.9 per cent for Zn deficiency.

As regards copper content, sufficiency level was observed in all the samples excepting 6.0 per cent of the samples analysed in Thiruchuli taluk. The iron content was below critical level in 2 per cent of the samples analysed and no manganese deficiency was observed in any of the samples analysed.

Simple correlation analysis for pH and various elements were done and its correlation values are given in Table 3. There was positive significant value between pH and Fe in Aruppukottai taluk ($r = 0.23^{*}$) while negative correlation for pH versus Fe was observed in Srivilliputhur taluk ($r = -0.43^{**}$). The negative association seen regarding pH and DTPA-Fe is quite explainable as above neutral pH, the divalent ionic species of Fe are reported to be converted into hydrated trivalent ionic species of Fe which are unavailable to plants (Mortvedt, 1991). The pH value and iron content of majority of samples in Aruppukottai taluk were above 7.00 and 15 - 20 ppm respectively as against below 10 ppm of iron was observed in most of the samples of Srivilliputhur taluk which may be the reason for positive correlation observed against pH in Aruppukottai taluk. The positive correlation was also obtained for pH

Table 1. Data on range, mean and per cent deficiency of micronutrients in the soils of Virudhunagar district

S.No.	Taluks	No.of samples	Range (mg kg^{-1})				Per cent deficiency			
			Zn	Cu	Fe	Mn	Zn	Cu	Fe	Mn
1	Aruppukkotai	88	0.20-4.20 (1.10)	0.60-5.10 (1.40)	2.10-28.0 (10.6)	3.0-34.0 (17.0)	54.0	-	2.00	
2	Rajapalayam	110	0.20-4.50 (1.10)	0.70-6.00 (2.70)	3.70-36..3 (12.6)	2.50-24..3 (10.0)	64.5	-	2.00	-
3	Srivilliputhur	40	0.20-4-00 (1.20)	0.90-4.80 (2.10)	4.30-41.8 (8.40)	3.00-19.4 (9.40)	47.0	-	-	-
4	Sattur	59	0.40-6.20 (1.30)	0.60-4.00 (1.90)	3.70-22.0 (10.4)	8.00-32.0 (18.1)	52.0	-	2.00	-
5	Thiruchuli	113	0.20-3.00 (0.60)	0.50-6.20 (1.20)	1.60-38.0 (1.20)	2.60-39.0 (15.0)	47.0	6.00	2.00	-
6	Virudhunagar	46	0.40-3.00 (1.30)	0.60-6.40 (2.00)	2.40-22.0 (10.3)	8.00-43.0 (20.6)	41.0	-	2.00	-
7	Mean	-	1.10	1.88	10.70	15.01	50.9	1.00	1.66	-

Table 2. Data on range, mean and per cent deficiency of micronutrients in the soils of Vellore district

S.No.	Taluks	No.of samples	Range (mg kg^{-1})				Per cent deficiency			
			Zn	Cu	Fe	Mn	Zn	Cu	Fe	Mn
1	Arcot	69	0.20 -3.00 (1.00)	1.00-8.60 (2.50)	2.00-38.0 (9.60)	2.00-30.0 (8.60)	63.0	5.00	1.00	-
2	Vellore	50	0.20-3.00 (1.10)	0.80-4.20 (2.20)	6.00-32.0 (13.7)	2.00-26.0 (17.6)	42.0	12.0	-	-
3	Gudiyatham	50	0.20-2.80 (1.20)	0.80-3.20 (2.20)	2.00-40.0 (14.0)	6.00-42.0 (18.0)	54.0	10.0	-	-
4	Vaniyampadi	50	0.20-3.20 (0..80)	0.80-4.00 (2.80)	2.00-26.0 (7.70)	2.00-42.0 (12.4)	82.0	2.00	2.00	-
5	Thiruputhur	39	0.20-2.20 (0.70)	1.00-8.80 (2.40)	2.00-34.0 (9.90)	2.00-32.0 (13.8)	82.0	7.00	2.00	-
6	Mean	258	0.96	2.42	10.98	14.08	64.6	7.2	0.83	-

Note : Figures in brackets indicate mean values.

versus Mn (r = 0.32*) and copper versus iron (r = 0.44*) in Srivilliputhur taluk and copper versus iron (r = 0.48**) in Rajapalayam taluk. Since ionic radii of Zn and Cu are more or less same, positive significant correlations were obtained for Zn versus Cu in Aruppukottai (r = 0.35**) and Thiruchuli (r = 0.34**) taluks. It may be attributed to the occurrence of site specific competition between zinc and copper (Gangwar *et al.*, 1989).

Vellore district : Soils of Vellore region were slightly acidic to alkaline (pH 6.3 to 8.2) and contained low soluble salts (0.08 to 0.80 dSm^{-1}). Among the micronutrients tested Zn deficiency was found widespread in all the taluks of Vellore district with Vaniyampadi and Thiruputhur taluks showing highest Zn deficiency of 82 per cent each with mean values of 0.80 and 0.70 mg kg^{-1} respectively. Soils of Arcot, Vellore and Gudiyatham taluks also exhibited 63, 54 and 42 per cent zinc deficiency respectively. Deficiency of copper ranging from 2 to 12 per cent were observed in different taluks of district. Iron content was found above critical level in all taluks with the exception of Vaniyampadi and Thiruputhur taluks which recorded 2 per cent deficiency (one sample) and manganese content was found sufficient in all the samples of Vellore district. The relevant data is given in Table 2. In this district, under wet-

land condition, three paddy crops are grown. In some taluks, groundnut-paddy-groundnut are followed, under garden land condition. Besides, sunflower is also intensively cultivated. Zinc deficiency may be the result of intensive cultivation.

Table 3. Correlation Matrix for soils of Vellore and Virudhunagar Districts

Vellore District

1.Vellore taluk

	pH	Zn	Cu	Fe	Mn
pH	-	0.08ns	0.28*	-0.22ns	-0.49**
Zn	0.08	-	0.13ns	0.15ns	-0.02ns
Cu	-0.28	-0.13	-	-0.23ns	-0.32*
Fe	-0.22	0.15	0.23	-	0.24ns
Mn	-0.49	0.02	-0.32	0.24	-

2.Arcot taluk

	pH	Zn	Cu	Fe	Mn
pH	-	-0.14ns	-0.04ns	0.02ns	-0.04ns
Zn	-0.14	-	-0.17ns	0.37**	0.06ns
Cu	-0.04	-0.17	-	-0.10ns	-0.03ns
Fe	0.02	0.37	-0.10	-	0.01
Mn	-0.04	0.06	-0.03	0.01	-

3.Vaniyampadi taluk

	pH	Zn	Cu	Fe	Mn
pH	-	0.13ns	-0.23ns	-0.01ns	0.19ns
Zn	0.13	-	0.11ns	0.01ns	-0.21ns
Cu	-0.23	0.11	-	0.01ns	-0.38**
Fe	-0.01	0.01	0.01	-	0.13ns
Mn	0.19	-0.21	-0.38	0.13	-

Virudhunagar District

1.Srivilliputhur taluk

	pH	Zn	Cu	Fe	Mn
pH	-	0.23ns	-0.18ns	-0.43**	0.32*
Zn	0.24	-	0.02ns	0.04ns	0.03ns
Cu	-0.18	0.01	-	0.44**	0.49**
Fe	-0.43	0.04	0.43	-	0.18ns
Mn	0.32	0.03	0.49	0.18	-

2.Rajapalayam taluk

	pH	Zn	Cu	Fe	Mn
pH	-	0.69ns	-0.07ns	0.06ns	-0.08ns
Zn	0.06	-	0.01ns	-0.11ns	0.09ns
Cu	-0.07	0.01	-	0.48**	0.10ns
Fe	0.06	-0.11	0.48	-	-0.12ns
Mn	-0.08	0.09	0.10	-0.12	-

3.Tiruchuli taluk

	pH	Zn	Cu	Fe	Mn
pH	-	0.05ns	0.03ns	0.12ns	0.08ns
Zn	0.05	-	0.34**	-0.20*	0.10ns
Cu	0.03	0.34**	-	0.03ns	0.38**
Fe	0.12	-0.20	0.03	-	0.11ns
Mn	0.08	0.10	0.38	0.11	-

4.Aruppukottai taluk

	pH	Zn	Cu	Fe	Mn
pH	-	0.04ns	-0.04ns	0.23*	0.05ns
Zn	0.04	-	0.35**	-0.39**	0.18ns
Cu	-0.04	0.51	-	-0.15ns	0.09ns
Fe	0.23	-0.39	-0.15	-	0.04ns
Mn	0.05	0.18	0.09	0.04	-

5.Virudhunagar taluk

	pH	Zn	Cu	Fe	Mn
pH	-	0.01ns	0.25ns	-0.15ns	-0.16ns
Zn	0.01	-	0.22ns	0.02ns	0.25ns
Cu	0.25	0.22	-	-0.01ns	0.43**
Fe	-0.15	0.02	-0.01	-	-0.31*
Mn	-0.16	0.25	0.43	-0.34	-

6.Sattur taluk

	pH	Zn	Cu	Fe	Mn
pH	-	0.03ns	0.19ns	-0.03ns	0.15ns
Zn	0.03	-	0.17ns	0.15ns	0.27*
Cu	0.19	0.17	-	0.12ns	0.19ns
Fe	-0.03	0.15	0.12	-	0.25ns
Mn	0.15	0.27	0.19	0.25	-

* - Significant at 5% : ** - Significant at 1%

ns - Non significant

The correlation values for soils of Vellore district is given in Table 3. There was a significant correlation between zinc and iron (r = 0.37**) in Arcot taluk only. While a signifi-

cant negative correlation was observed between copper and manganese in Vellore ($r = -0.32^{*}$) and Vaniyambadi ($r = -0.38^{**}$) taluks. Similarly, significant positive and negative correlation were observed respectively for pH versus copper ($r = 0.28^{*}$) and pH versus manganese ($r = -0.49^{**}$) in Vellore taluk. While correlation values between the nutrients was insignificant in Gudiyatham and Thiruputhur taluks.

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