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Aswathy S Nair
Department of Soil Science, Tamil Nadu Agricultural University (TNAU), Coimbatore, Tamil Nadu, India

S Thyigeshwari
Department of Soil Science, Tamil Nadu Agricultural University (TNAU), Coimbatore, Tamil Nadu, Idina

D Muthumanickam
Department of Soil Science, Tamil Nadu Agricultural University (TNAU), Coimbatore, Tamil Nadu, India

Correspondence
Aswathy S Nair
Department of Soil Science, Tamil Nadu Agricultural University (TNAU), Coimbatore, Tamil Nadu, India

Assessment and reassessment of secondary and micronutrient status between 1980-2000 and effect of garden land environment on soil properties and availability of micronutrients in Ramanathapuram district of Tamil Nadu using GPS and GIS technology

Aswathy S Nair, S Thyigeshwari and D Muthumanickam

Abstract
Totally 1820 geo-referenced surface soil samples covering 455 panchayat villages in 11 blocks of Ramanathapuram district were collected to assess the available sulphur and micro nutrient status in soils besides to create a data bank on soil fertility status including multi nutrient status. The study involved assessment and reassessment of multinutrient and single nutrient 1980-2000. From the present investigation, it is revealed that ZnCuB; FeZnCu and FeZnB was observed as three nutrient deficiencies in Ramanathapuram district with a mean of 17.9, 0.3 and 0.2 per cent respectively. Higher per cent of three nutrient deficiencies viz., ZnCuB was observed in Thiruvadanai block and lower per cent was observed in Nainarkovil. ZnCu registered the highest percentage of two nutrient deficiencies. Maximum individual deficiency of Zn, Cu and B nutrients observed as single nutrient deficiency with a mean of 26.4, 5.7 and 4.6 per cent respectively. The assessment revealed that percentage of deficient samples was 46.7, 4.1, 19.0 and 6.0 per cent was respectively for Zn, Cu, Fe and Mn.

Keywords: DTPA – extractable micronutrients, multinutrient deficiency, reassessment and assessment.

Introduction
The crucial role played by micronutrients in enhancing crop production in India is now well recognized fact. Widespread micronutrient deficiencies in crops now being well recognized fact. Widespread micronutrient deficiencies in crops. Now being recorded all over the country, have resulted in severe losses in yield and nutritional quality. It is estimated that nearly half of the soils on which food crops are grown, are deficient in zinc (Zn). Next to Zn, boron (B) (33%) and iron (Fe) (15%) are also limiting the crop production to a large extent. Micronutrient requirements are steadily increasing worldwide and the widespread deficiency of micronutrients in the soils could be attributed to several reasons such as natural deficiency existing in some soil types, geology, climatic factors, crop removal, soil, water and crop management practices, destruction of organic matter etc. Low availability of micronutrients in the normal and calcareous soils is the important abiotic stress observed in world agriculture and it was reported that, about 10 M ha area is found to be Zn deficient and approximately more than 85 per cent of the deficiency was observed in calcareous soils having high pH (Singh *et al*. 2005). The extent of micronutrient deficiency varies not only in different states and districts but also in different blocks within the district. Micronutrient deficiencies is the one of the main causes for low yield or crop yield decline in irrigated (Katyal and Rattan 2003) [2] and rainfed cropping system in agriculture (Rego *et al.* 2007) [3]. On the basis of computation of exhaustion period of micronutrient reserve under different cropping system soil zinc is the most limiting micronutrients followed by copper (Rattan *et al.* 2009). Besides soil charectersitics, land use pattern also plays a vital role in governing the nutrient dynamics and fertility of soils (Vijayakumar *et al*. 2011) [4]. Assessing and mapping the fertility status of soils precisely using GPS techniques provides a great opportunity to plan for sustaining the productivity of crops and improving the economy of the country.

Hence, the study was conducted to assess the micronutrient availability of soils in Ramanathapuram district of Tamil Nadu.

Materials and Methods

One hundred and eighty three samples were collected from rainfed rice growing areas of Ramanathapuram district in eleven blocks. Two hundred and twenty four samples were collected from rainfed chillies growing areas of Ramanathapuram district. The surface geo referenced soil samples were processed and analysed for pH, organic carbon, CEC, and available nitrogen, phosphorus and potassium following standard methods. The DTPA – extractable Fe, Zn, Mn and Cu were extracted with di-ethelene tri- amine penta-acetic acid (DTPA) solution (Lindsay and Norwell 1978) and subsequently analysed with the help of atomic absorption spectrophotometer (Chemito-203)

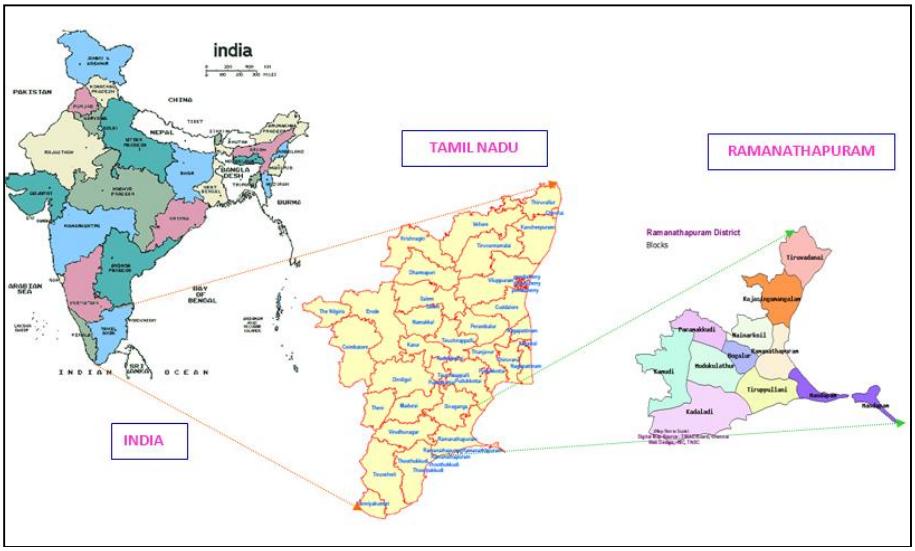

Fig 1

Results and Discussion

Table 1: Number of geo-referenced soil samples collected from Ramanathapuram district

S. No	Taluk name	Black name	No. of samples
1	Thiruvadanai	1. Rajasingamangalam	152
		2. Thiruvadanai	196
2	Paramakudi	3. Nainarkoil	152
		4. Bogalur	104
		5. Paramakudi	164
3	Mudukulathur	6. Mudukulathur	208
4	Kamudi	7. Kamudi	220
5	Kadaladi	8. Kadaladi	248
6	Ramanathapuram	9. Ramanathapuram	112
		10. Tiruppullani	144
7	Ramanathapuram & Rameswaram	11. Mandapam	120
		Total	1820

Table 2: Comparison of Secondary and micronutrient status between assessment and reassessment of soils in Ramanathapuram district

S. No	Particulars	1980- 2000 assessment	Present Reassessment	Change in status
1	No. of samples	760	1820	
2	Zn deficiency	46.7	79.1	+ 32.4
3	Cu deficiency	4.1	46.0	+ 41.9
4	Fe deficiency	19.0	1.1	- 17.9
5	Mn deficiency	6.0	0.2	- 5.8
6	B deficiency	NA	42.6	-
7	S deficiency	NA	4.3	-

The comparative analysis was made to find out the status of Secondary and micronutrient between 1980 -2000 assessment and present reassessment (Table 2) from the soils collected from Ramanathapuram district. The results of 1980 -2000 assessment observed that 46.7, 4.1, 19.0 and 6.0 per cent of the soils of Ramanathapuram district were deficient in Zn, Cu, Fe and Mn respectively. In the case of present reassessment study revealed that the deficiency percentage of 79.1, 46.0, 1.1 and 0.2 was noticed for Zn, Cu, Fe and Mn. Apart from this 42.6 and 4.3 per cent samples were deficient in HWSB and available Sulphur.

The result of the present delineation study revealed that decline in Fe and almost nil deficiency of Mn was noticed. For Zn and Cu deficiency were increased to the tune of 32.4

and 41.9 per cent and Cu deficiency is an alarming and needs proper management technologies.

Table 3: Assessment of Multi-micro nutrient deficiency status in soils of Ramanathapuram district

S. No	Name of blocks	Samples collected	No. of samples deficient	Single nutrient	Two nutrients	Three nutriets
1	Rajasingamalam	152	132	52	61	19
2	Nainarkoil	152	144	105	36	3
3	Bogalur	104	96	39	39	18
4	Paramakudi	164	155	74	70	11
5	Ramanathapuram	112	102	26	55	21
6	Tiruppullani	144	135	43	69	23
7	Mudukulathur	208	202	37	95	70
8	Kamudi	220	192	69	86	37
9	Kadaladi	248	238	150	76	12
10	Thiruvadani	196	191	21	94	76
11	Mandapam	120	110	53	15	42
	Total	1820	1697	669	696	332

From the present investigation, it is revealed that ZnCuB; FeZnCu and FeZnB was observed as three nutrient deficiencies in Ramanathapuram district with a mean of 17.9, 0.3 and 0.2 per cent respectively and the total number of deficient samples in each block for the entire district is given in table 31. Higher per cent of three nutrient deficiencies viz., ZnCuB was observed in Thiruvadanai block (38.8 per cent) and lower per cent was observed in Nainarkovil (1.3 per cent), however very scarce amount of FeZnCu and Fe Zn B deficiency was noticed in the district (Table 32). Two nutrient deficiencies such as ZnCu, ZnB, CuB and FeZn was observed in the district with a mean of 18.7, 14.9, 3.9 and 0.3 per cent respectively. The highest per cent of ZnCu deficiency was registered in Paramakudi block (38.4 per cent) and lower per cent of ZnCu deficiency noticed in Mandabam block (5.8 per cent). The highest per cent of ZnB deficiency observed in Bogalur block (29.8) and lower per cent of ZnB deficiency noticed in Mandabam block (2.5 per cent). The highest per cent of CuB deficiency observed in Rajasingamangalam block (21.7) while the nil percentage was observed in Bogalur block.

Individual deficiency of Zn, Cu and B nutrients observed as single nutrient deficiency with a mean of 26.4, 5.7 and 4.6 per cent respectively. In Paramakudi block, only one soil sample showed the single nutrient deficient of Fe were noticed. Similarly as that of Fe, only one sample was deficient for Mn in Nainarkovil, Paramakudi, Kamudi and Mandabam block. Zn was appeared as widespread single nutrient deficiency in all the blocks of Ramanathapuram district in which Nainarkovil block registered the maximum deficiency of 61.2 per cent. The highest single nutrient deficiency of Cu was noticed in the soils of Tirupullani block (18.8 per cent) and the samples from Ramanathapuram was found that non deficient in single nutrient category of Cu. In the case of HWSB, the single nutrient deficiency percentage of 15.9 was registered in the soils of Kamudi block and none of the soil samples from the blocks of Bogalur and Mandabam weren't deficient in single nutrient category of HWSB.

From this assessment of Multi-micro nutrient deficiency status in the soils of Ramanathapuram district revealed that an overall percentage of 36.68, 37.90 and 18.39 samples were deficient in single, two and three nutrients respectively. Perusal of the thematic map clearly depicts the severity of deficiency micronutrient especially for Zn, Cu and B in Ramanathapuram district and revealed the importance of site specific nutrient application

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