Macro and Micronutrient Status in Rice Growing Coastal Land Area of Tharangambadi Taluk of Nagapattinam District in Tamil Nadu, India.

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Abstract

Soil nutrients are essential for growth of plants which improve both the soil fertility and yield of the crops. Surface soil samples depth (0 – 20 cm) numbering 110 from 22 revenue villages in which five samples were collected from each revenue village. The basic physico –chemical parameters pH, EC and OC and macronutrients N, P, K were analyzed by standard methods. The available DTPA (Diethylene Triamine Penta Acetic acid) extractable micronutrients Zn, Fe, Cu and Mn were investigated by using atomic absorption spectrophotometer (ECIL, AAS-4129).The study area covers 22 revenue villages in coastal rice growing agriculture land area of Tharangambadi taluk in Nagapattinam District in Tamilnadu. The planned work is very essential not only for crop production but also to maintain soil fertility, It also helps to maintain hazardous free environment and enhance the living standard in which turn to uplifts our Formers. Formers are advised to rotate the crops which are affected by saline water in the coastal area. From the results of the analysis of soil samples, precise suggestions can be made to develop the soil quality and crop yield.

Keywords: Macronutrients, micronutrients, coastal soil, Tharangambadi taluk,

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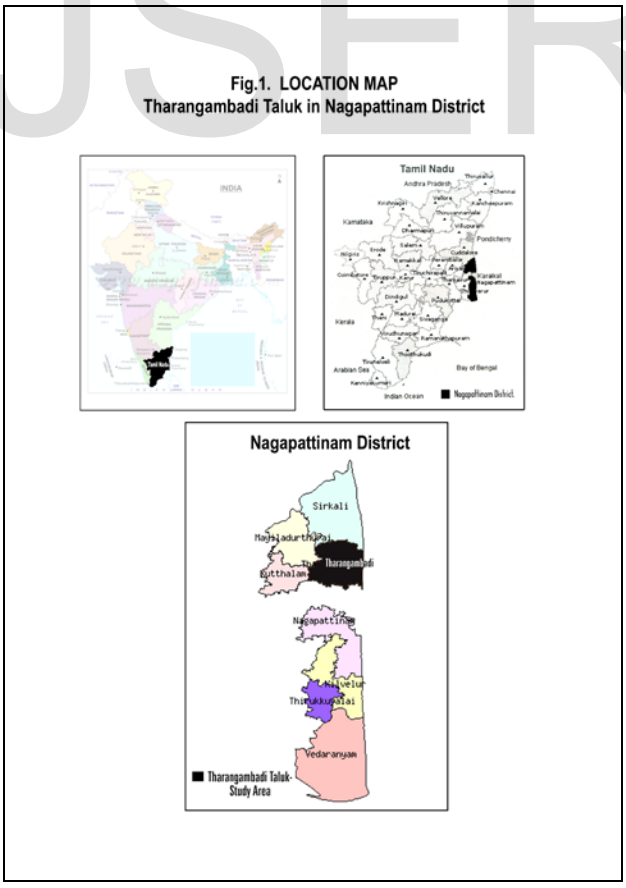
Introduction

Surface soil samples depth (0 – 20 cm) numbering110 from 22 revenue villages, five samples were collected from each revenue village. The basic physico –chemical parameters pH, EC and OC were calculated in the study area. N, P, K analyzed by standard methods. Assess the micronutrient status by using Atomic Absorption Spectrophotometer. By using the critical levels fixed by earlier workers for DTPA (Diethylene Triamine Penta Acetic acid) extractable micronutrients in Tamilnadu soils, the percentage deficiencies of individual nutrients were calculated in each revenue village. Although widespread micronutrient deficiency has been observed in the soils of Tamil Nadu, especially the nutrient Zn deficiency [1] .From the results of the analysis of soil samples, concrete suggestions can be made to improve the soil quality and crop production. The result of numerous field experiments in different parts of India have, therefore indicated "fertilizer induced unsustainability of crop productivity" [2]. Although widespread micronutrient deficiency has been observed in the soils of Tiruchirappalli District of Tamil Nadu, specially the nutrient Zn deficiency [3], the information with respect to availability of macro and micronutrients and soil characteristics of the study area was lacking.

Study Area

Tharangambadi taluk is the Coastal region of Bay of Bengal between Northern Latitude 11.10450degrees and 79.500580 degrees Eastern Longitude. The study area covers Coastal Agriculture land area of Tharangambadi taluk of Nagapattinam district in Tamilnadu state. (Fig.1)



Material and Methods

The processed soil samples were analyzed for physico-chemical properties using standard procedures [4].N, P, K analyzed by standard methods. The air-dried and processed soil samples size (<2mm) were extracted with DTPA-$CaCl_2$-TEA solution [1] and the available Fe, Mn, Zn and Cu content in the extract was determined with the help of an atomic absorption spectrophotometer (ECIL, AAS-4129).Simple averaging of soil test values for each micronutrient was done to get the average status in the villages. Using the critical levels fixed by earlier workers for DTPA extractable micronutrients in TN soils, the percentage deficiencies of Individual nutrients were calculated in each village.The critical levels for DTPA extractable micronutrients were fixed [5].

Result and Discussion

The results of the macro and micronutrients of 22 villages are given in Table-1.

The relative high pH of the soils might be due to the presence of high degree of base saturation. The electrical conductivity, organic carbon, of the soils varied from 0.40 to 0.80 dsm^{-1} and 0.20 to 0.25% with a mean value of 0.50 dsm^{-1},and 0.22% respectively. On the basis of the limits suggested [6] for judging salt problems of soils, all samples (100%) were found (EC<1.0). The organic carbon content was low (<0.50%) in 100% soil samples. High temperature and good aeration in the soil increases the rate of oxidation of organic matter resulting reduction of organic carbon content.

Available N content varied from 160 to 285 Kg ha^{-1} with an average value of 229.09 kg ha^{-1}. On the basis of the ratings suggested [7], 64% samples were low (<250 N Kg ha^{-1}) 36% medium (250 to 500 N kg ha^{-1}). This is because most of the soil nitrogen is in organic forms. Similar result was reported [8].

The available phosphorus content varied from 12.5 to 47.5 kg ha^{-1} with a mean value of 25.0 kg ha^{-1} . The range is considerably large which might be due to variation in soil properties viz., pH, organic matter content, texture and various soil management and agronomic practices. On the basis of the limits suggested [6], 36% samples were low (<20 P_2O_5 kg ha^{-1}) and 64% medium (20 to 50 P_2O_5 kg ha^{-1}). This might be due to the presence of more than 50% of phosphorus in organic forms and after decomposition of organic matter as humus is formed which forms complex with Al and Fe and that is a protective cover for P fixation with Al and Fe thus reduce phosphorus adsorption/ Phosphate fixation [9].

Status of available potassium (K_2O) in the soils ranged from 310.0 to 445 kg ha^{-1} with an average of 361.02kg ha^{-1}. According to [6], 100% samples were high (>300 k_2O kg ha^{-1}) in potassium content. This might be due to creation of favourable soil environment with presence of high organic matter. Similar results were reported [10].The average mean values of Macro and Micronutrients status shown in Fig.1& 2.

Soil Nutrient Index

Soil test information is compiled area wise in the form of "Soil test summaries" which indicate the number of samples falling in the category of low, medium and high status of N, P and K. This information are used to work out from nutrient Index (NI) or parker index, which in turn used to develop soil fertility map of an area.

Nutrient index and soil fertility map;

$$NI = \frac{Nl + 2Nm + 3Nh}{Nl + Nm + Nh}$$

Where Nl, Nm and Nh are the number of samples falling in the category of low, medium and high nutrient status and are given waightages of 1, 2 and 3 respectively. Considering the concept of "Soil Nutrient Index" the soils of study area were found in category of "medium fertility status" for nitrogen and phosphorus and 'high' with respect to potassium. The values worked out from nutrient Index for nitrogen, phosphorus and potassium were 1.36, 1.63 and 3.0 respectively, against the nutrtient. Index values < 1.5 for low, 1.5 to 2.5 for medium and > 2.5 for high fertility status of area.

The content of Zn, Fe, Cu and Mn varied from 0.60 to 1.70, 3.50 to 22.40, 1.05 to 2.60 and 1.90 to 3.30 mg kg^{-1} with mean values of 1.31, 13.05, 1.72 and 2.76 respectively. On the basis of critical limits suggested [11] (<0.6 mg kg^{-1} for deficient, 0.6 to 1.2 mg kg^{-1} for marginal and > 1.2 mg kg^{-1} for sufficient) 41% samples were marginal and 59% samples were sufficient in available Zn. Considering the critical limits (4.5 mg kg^{-1}) proposed [1]. All the soil samples were sufficient in available Fe. All the soil samples were sufficient in available Cu and Mn considering 1.2 mg kg^{-1} for Cu and 2.0 mg kg^{-1} for Mn as critical limits suggested [1]. Similar results were reported [12].

Table-1. Salient soil properties (weighted mean) of Study Area

S. No.	Name of Village	No. of samples collected	EC (ds m^{-1})	pH	OC%	N	P_2O_5	K_2O	Zn	Fe	Cu	Mn
						kg ha^{-1}			mg kg^{-1}			
1	Koodalore	5	0.60	7.50	0.23	222.5	17.5	360.0	1.68	14.0	1.80	2.75
2	Eravancheri	5	0.70	7.56	0.22	237.5	27.5	402.5	1.70	19.50	1.72	2.80
3	Nalladai	5	0.50	7.6	0.23	160.0	25.0	310.0	1.68	18.0	1.67	2.85
4	Marudhampallam	5	0.60	7.4	0.22	175.0	12.5	317.5	1.70	9.65	1.81	2.89
5	Mamakudi	5	0.65	7.2	0.22	192.5	37.5	375.0	1.68	20.45	1.43	2.70
6	Kidangal	5	0.70	7.4	0.23	175.0	35.0	337.5	1.58	22.40	1.84	2.90
7	Memathur	5	0.60	7.5	0.22	275.0	22.5	347.5	1.69	21.0	1.70	3.10
8	Mathur	5	0.80	7.6	0.23	217.5	20.0	360.0	1.50	19.0	1.80	2.70
9	Thirukadaiyur	5	0.70	7.0	0.25	277.5	37.5	372.5	1.69	18.00	1.79	3.0
10	Pillaiperumanallore	5	0.70	7.1	0.23	285.0	47.5	367.5	1.40	19.0	1.90	2.90
11	Manikkapangu	5	0.50	7.0	0.22	277.5	27.5	352.5	1.05	18.50	2.03	2.01
12	Erukattacheri	5	0.40	6.8	0.20	285.0	25.0	310.0	1.56	18.0	2.60	1.90
13	Ilupur	5	0.40	6.9	0.21	227.5	17.5	377.5	0.60	9.50	1.74	2.90
14	Eduthukatti	5	0.50	7.2	0.22	185.0	35.0	422.5	1.30	6.50	1.50	2.60
15	Thirukklacheri	5	0.70	6.7	0.20	205.0	22.5	435.0	1.0	6.0	1.59	2.50
16	Thiruvidaikazhi	5	0.40	7.2	0.22	185.0	12.5	445.0	1.02	6.40	1.05	2.90
17	Thillaiyadi	5	0.50	7.4	0.23	260.0	12.5	377.5	1.30	7.80	1.60	3.0
18	Kattucheri	5	0.55	7.35	0.23	192.5	22.5	360.0	0.90	9.0	1.68	2.53
19	Poraiyar	5	0.40	7.8	0.20	225.0	30.0	317.5	0.82	7.0	1.90	3.30
20	Chandrapadi	5	0.40	7.4	0.22	222.5	27.5	327.5	0.90	3.50	1.69	2.80
21	Melaperumpallam	5	0.45	7.1	0.23	285.0	17.5	320.0	1.0	7.0	1.53	2.90
22	Keelaperumpallam	5	0.60	7.5	0.22	272.5	17.5	347.5	1.11	6.9	1.52	2.89
Range			0.40-0.80	6.7-7.8	0.20-0.25	160.0-285	12.5-47.5	310-445	0.60-1.70	3.50-22.40	1.05-2.60	1.90-3.30
Mean			0.50	7.28	0.22	229.09	25.0	361.02	1.31	13.05	1.72	2.76

Fig.1 Average Mean value of Macronutrients status in Coastal Land Area of Tharangambadi Taluk

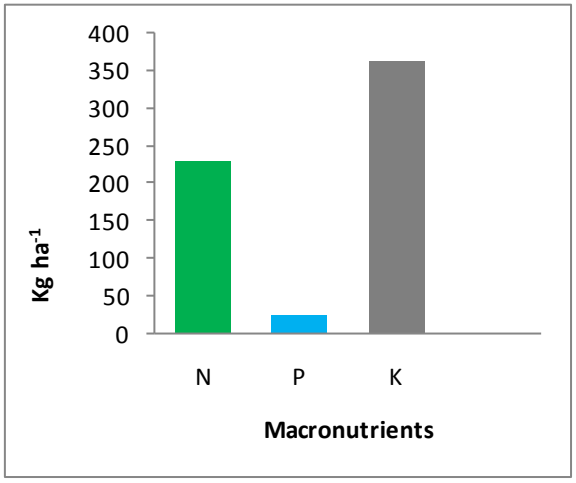
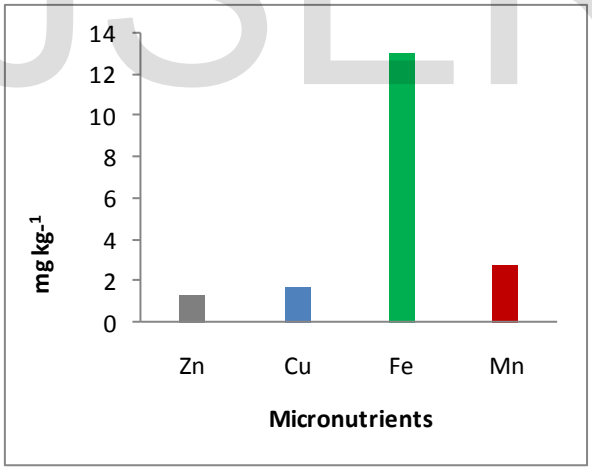


Fig.2 Average Mean value of Micronutrients status in Coastal Land Area of Tharangambadi Taluk



Conclusion:

In view of the concept of "Soil Nutrient Index" the soils of study area were found in category of low fertility status for Nitrogen, Phosphorus and Potassium. The values worked out from nutrient Index for Nitrogen, Phosphorus and Potassium were 1.36, 1.63 and 3.0 respectively, against the nutrient index values < 1.5 for low, 1.5 to 2.5 for medium and > 2.5 for high fertility status of area. Among the four micro nutrients available Fe, Cu and Mn were sufficiently present in all the soil samples. In all the villages Zn was found to be marginal in all soil samples. Zn deficiency leads to widespread nutritional disorder in various crops. In case of field crops, soil application of $ZnSO_4$, @ 15-25 kg ha^{-1} can be done before sowing or transplanting. Foliar sprays of 0.5% $ZnSO_4$, 2-3 times at 10-15 days interval can be effective in correcting Zn deficiency in standing crops. Further, application of Zn along with organic manures may enhance the availability and efficiency of Native Zn through chelation.

References:

[1] Lindsay, W.L. and Norvell, W.A. (1978). Development of DTPA soil test for Zn, Fe, Mn and Cu. *Soil Science Society of American Journal*, 42, 421-428.
[2] Yadav, J.S.P. (2003). Managing Soil Heath for sustained high productivity. *Journal of the Indian Society of Soil Science* 51, 448-465.
[3] Martin Deva Prasath, P.(2008). Assessment of Micronutrient status at Tiruchirappalli District, Tamil Nadu, proceedings of National Conference on *'Impending Approaches to Environmental Menace'*. 117, 122.
[4] Jackson, M.L. (1973). *Soil Chemical Analysis*, Prentice Hall of India Pvt. Ltd., New Delhi.
[5]Tandon, HLS.(1999).Methods of Analysis of Soils, Plants, Water and Fertilizers, Fertilizer Development and Consolation Organization, New Delhi, India pp 144+ VI.
[6] Muhr, G.R., Datta, N.P., Shankara Subraney, N., Dever, F., Lecy, V.K. and Donahue, R.R. (1963). *Soil Testing in India*. USAID Mission to India.
[7] Subbiah, B.V. and G.L.Asija, (1956). A rapid procedure for the determination available nitrogen in soils. **Current Sci., 25**: 259-260.
[8] Paliwal, M.L. (1996). studies on major and micronutrient status of soils of panchayat samiti Bhinder (Dist. Udaipur). M.Sc.(Ag.) thesis, Rajasthan Agricultural University, Bikaner.
[9] Tisdale, S.L., Nelson, W.L., Beaton, J.D. and Havlin, J.L. (1997). *Soil Fertility and Fertilizers, 5th Edition, Macmillan publishing Co.,* New Delhi. PP.144, 180, 198, 201.
[10] Chouhan, J.S.(2001) fetility status of soils of Bilara panchayat Samiti of Jodpudistrict(Rajasthan). M.Sc.(Ag.)Thesis, MPUAT, Udaipur.
[11] Takkar, P.N. and Mann, M.S. (1975). *Agrochemical* 19, 420.
[12] Sharma, R.P., Megh Singh, Sharma, J.P.(2003). Correlation studies on micronutrients vis-à-vis soil properties in some soils of Nagaur district in semi-arid region of Rajasthan, *Journal of the Indian Society of Soil Science* 51, 522-527.