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Soil Fertility Status and Biological Ananlysis of Some Selected Rural Agriculture Land Area of Mayiladuthurai Taluk of Mayiladuthurai District - Tamil Nadu, India

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Abstract
The combination of mineral, organic matter, living things and pore spaces for the soil samples Soil nutrients are more important plant growthto improve both the soil fertility and yield of the crops. Macronutrients (N, P and K) and micronutrients (Zn, Cu, Fe and Mn) are agriculturally important soil elementswhich control its fertility.Supply of various nutrient is natural phenomenon and some of them may be sufficient where others deficient.The present study assesses the soil quality parameters in paddy growing agriculture land area of Mayiladuthurai taluk of Mayiladuthuraidistrict, Tamilnadu. Surface soil samples depth (0 – 20 cm) numbering 35 from 7revenue villagesin which five samples were collected from each revenue village. Soil samples were processed to analyse for physico - chemical properties using standard procedures.From the results of the analysis of soil samples can be made to improve the soil quality and crop yield.

Key words: Macronutrients, micronutrients, Soil, Mayiladuthurai taluk.

1. Introduction

The aim of this research work is to assess the Macro and Micronutrient status of soil in Mayiladuthurai taluk of MayiladuthuraiDistrict, Tamilnadu, India. In this study, the Individual deficiency/sufficiency of Macronutrients (N,P&K)and four agriculturally important micronutrients namely Zinc (Zn), Copper (Cu), Iron (Fe) and Manganese (Mn) are studied. Based on the results, concrete suggestions can be made to these area farmers to improve the soil quality and crop production.The study area Mayiladuthurai taluk of Mayiladuthurai District is one of the important taluk of Tamil Nadu as it is the centre of attraction for Tourism, Industrialization, crop production, fishers and port which are the main sources of economy. Further, the study area is frequently affected by natural disasters like cyclone, heavy rains, floods, sea water intrusion and tsunami,now a days people are using ground water from deep bore wells and also oil bore wells change the ground water quality, which results in major changes in the soil surface. Hence an attempt has been made to evaluate the soil quality and based on the results, possible remedial measures can be suggested to improve the quality of the soil.Surface soil samples depth (0 – 20 cm) numbering 35 from 7 revenue villages, five samples were collected from each revenue village. The basic physico –chemical parameters pH and EC were calculated in the study area. N, P, K analyzed by standard methods.

Atomic Absorption Spectrophotometer is used to assess the micronutrient status. The range for criticalityhas fixed by earlier researchers for DTPA (Diethylene TriaminePenta Acetic acid) extractable micronutrients in Tamilnadu soils, the percentage deficiencies of individual nutrients were calculated in each revenue village. Micronutrient deficiency has been observed widely in the soils of Tamil Nadu, especially the nutrient Zn deficiency [1] .From the results of the analysis of soil samples, concrete suggestions has been made to improve the soil quality and crop production. Numerous field experiments resultsin 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] and the similar result reported to Mayiladuthurai District of Tamilnadu[4] the information with respect to availability of macro and micronutrients and soil characteristics of the study area was lacking.

The pH of soil is more important feature for soil fertility. pH is not probably a plant nutrient, but rather is a measure of the acidity of the soil. The plants will grow fast while the soil pH falls between 6.2 and 6.8. The plant nutrients availability of some greatly affected by soil pH. The “ideal” soil pH is close to neutral soils,

and neutral is considered to fall within a range from a slightly acidic pH of 6.5 to a slightly alkaline pH of 7.5. Most plant nutrients are optimal, and it has been determined that available to plants within this 6.5 to 7.5 pH range, plus this range of pH is generally very compatible with plant root growth[5].Demand for information there is an increase in soils as a means to produce food [6]. Agriculture is the predominant economic activity in Mayiladuthurai taluk and because of agricultural development and increasing demand for experimental data in Mayiladuthurai district, much work is carried out on soil characterization. Provides soil classification schemes with the basic information necessary to create functional and assess soil fertility in order to unravel some unique soil problems in an ecosystem[7].

2. Study Area

The study area is MayiladuthuraiTaluk ofMayiladuthurai District coastal region in the southern Tamilnadu State located in the coastal region of Bay of Bengal 11.101840 Latitude and 79.652222 Longitude.This taluk is spread over in 24,485 hectares of Agriculture land. Fig.1 shows the study area.The area is intensively cultivated in an array of crops such as Rice, Mize, Sugar cane, cowpea, and millet. The length of the growth period is 90-150 days [8]. It is characterized by a long dry season from October through May/June and a short but intense wet season from May/June through September with mean annual rainfall slightly below 750 mm. Shows a marked seasonal The rainfall pattern variation with a single peak reaching maximum in August [9].

3. Materials and Methods

The processed soil samples were analyzed for physico-chemical properties using standard procedures [10].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 [11].

4. Result and Discussion

The results of the macro and micronutrients of 7 villages are given in Table-1.

The comparative high pH of the soils might be due to the presence of high degree of base impregnate. The electrical conductivity of the soils varied from 0.11 to 0.35 $dsm^{-1}$with a mean value of 0.22 dsm^{-1}. On the basis of the limits suggested [12] for judging salt problems of soils, all samples (100%) were found (EC<1.0). 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 49.56 to 68.6 Kg ha^{-1} with an average value of 57.28 kg ha^{-1}. On the basis of the ratings suggested [13],100% samples were lowN content(<250 N Kg ha^{-1}). This is because most of the soil nitrogen is in organic forms. Similar result was reported [14].

The available phosphorus content varied from 7.4 to 48.0 kg ha^{-1} with a mean value of 29.23 kg ha^{-1}. The range is considerably large which might be due to variation in soil properties viz., pH, texture and various soil management and agronomic practices. On the basis of the limits suggested [12], 42.85% samples were low (<20 P_2O_5 kg ha^{-1}) and 57.15% medium (20 to 50 P_2O_5 kg ha^{-1}) in phosphorus content. 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 [15].

Status of available potassium (K_2O) in the soils ranged from 136.8 to 317 kg ha^{-1} with an average of 212.89kg ha^{-1}. According to [12], 71.43 % samples were medium (125 to 300 k_2O kg ha^{-1}) and 28.57 % samples were high (>300 k2O kg ha-1) in potassium content. This might be due to forming of pleasing soil environment with presence of high organic matter. Similar results were reported [16].The average mean values of pH,EC

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and OC shown in Fig.2. The average mean value of macro and micronutrients status shown in Fig.3&4 and the deficiency percentage of micronutrients status shown in Table.2 and Fig.5.

The deficiency of Iron will cause yellow or white areas between veins of young leaves, and excess of Iron leaves with tiny brown spots. The deficiency of Cuwill causes Leaves become light green and develop twisted tips, and excess of Cu causes biological plant effects like Toxic to the plants may produce synergetic and antagonistic effect. The deficiency of Mnwill causes Interveinal yellowing or mottling of young leaves, and excess of Mn causes Older leaves have brown spots Surrounded by a chlorotic circle or zone. The deficiency of Znwill causes Interveinal yellowing on young leaves reduced leaf size, and Excess zinc may cause Iron deficiency in some plants.

Soil Nutrient Index

Soil test details is compiled area wise in the form of "Soil test summaries" which designate the number of samples falling in the category of low, medium and high status of N, P and K. This particularis 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 drop down in the category of low, medium and high nutrient status and are given waightages of 1, 2 and 3 respectively. Considering the hypothesis of "Soil Nutrient Index" the soils of study area were found in category of very low fertility status for nitrogen. The phosphorus and potassium were found to be medium category.The values worked out from nutrient Index for nitrogen, phosphorus and potassium were 1.0, 2.14 and 2.29 respectively, against the Nutrient Index values < 1.5 for low, 1.5 to 2.5 for average and > 2.5 for high fertility status of area.

The content of Zn, Fe, Cu and Mn varied from 0.63 to 1.0, 3.94 to 10.4, 0.74 to 5.51 and 1.74 to 5.51 mg kg-1 with mean values of 0.78, 6.27, 1.79 and 2.97 respectively. On the basis of critical limits suggested [17] (<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) 100% samples weredeficient in available Zn. 100 % soil samples were sufficient in available Fe. 71.42% soil samples were deficient in available Cu and 28.58% samples were sufficient in Cu content. 57.15% of sample possesses sufficient level of Mn and 42.85% samples were deficient in Mn content.Considering 1.2 mg kg^{-1} for Cu and Zinc. 2.0 mg kg^{-1} for Mnand 3.7 mg kg^{-1} for Fe as critical limits suggested [11]. Similar results were reported [18]

Table. 1. Basic descriptive statistics for pH, EC, N, P and K revealed at Mayiladudurai Taluk

S.No	Name of the villages	pH	EC	N	P	K
1	Araiyapuram	7.66	0.35	63.28	43	217
2	Anjalaru	7.6	0.31	68.6	43	217.6
3	Kallikadu	7.68	0.26	50.96	48	317
4	Kandiur	7.66	0.31	49.56	48	312
5	Sendiruppu	7.32	0.11	56.84	7.7	144.6

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6	Ukkadi	7.42	0.11	55.72	7.4	136.8
7	Varakadai	7.36	0.11	56	7.5	145.2
Mean Value		**7.53**	**0.22**	**57.28**	**29.23**	**212.89**

Table.2. Average Mean value of Cu, Fe, Mn and Zn.

S.No	Name of the villages	Cu	Fe	Mn	Zn
1	Araiyapuram	0.77	3.94	2.3	0.75
2	Anjalaru	0.76	3.96	1.93	0.78
3	Kallikadu	0.74	4.38	1.77	0.64
4	Kandiur	0.74	4.38	1.74	0.63
5	Sendiruppu	0.77	10.4	4.33	1
6	Ukkadi	5.51	7.4	5.51	0.98
7	Varakadai	3.24	9.43	3.24	0.7
Mean Value		**1.79**	**6.27**	**2.97**	**0.78**

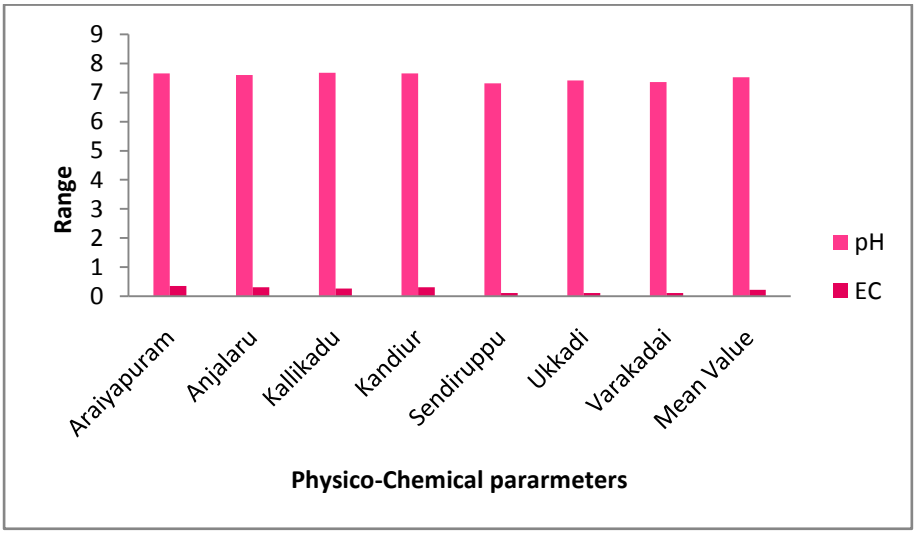

Fig. 1. Average mean value of pH and EC status in Mayiladuthurai Taluk

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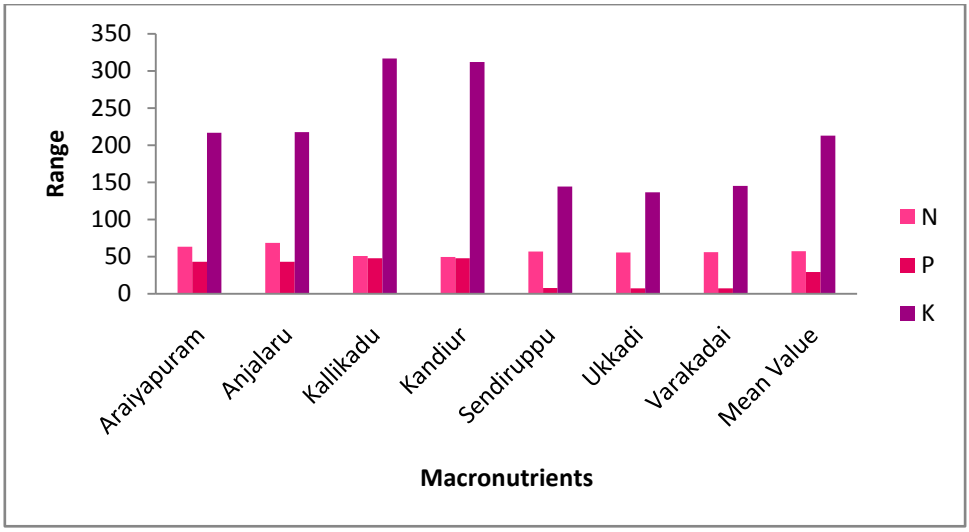

Fig.2.Average mean value of Macronutrients status in Mayiladuthurai Taluk

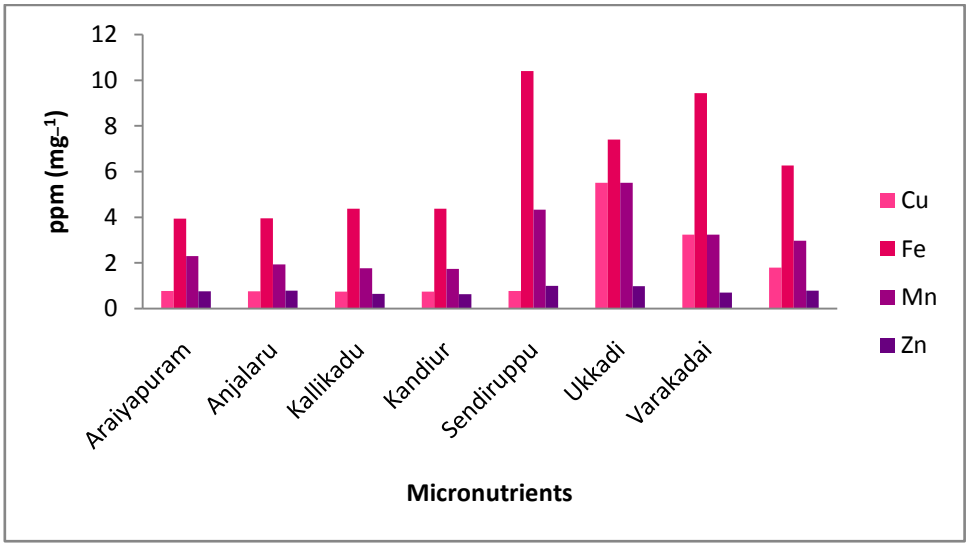

Fig. 3. Average mean value of Micronutrients status in Mayiladuthurai Taluk

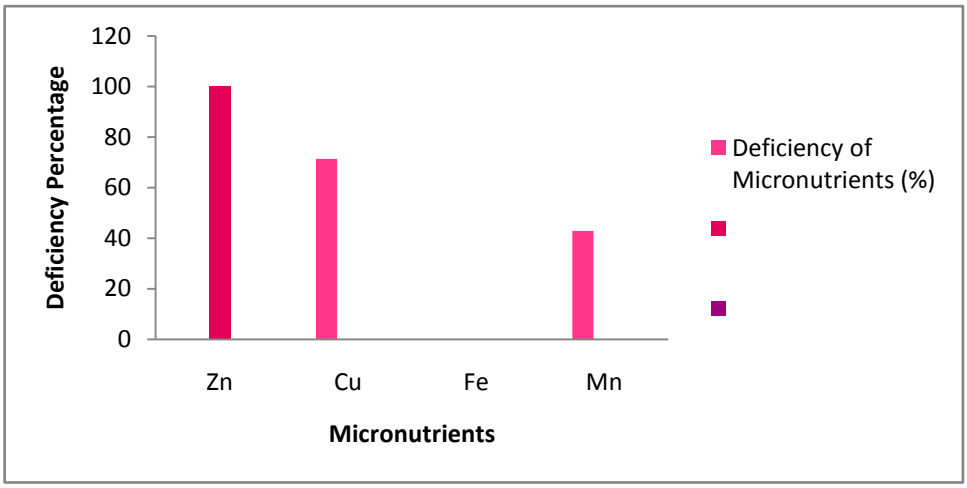

Fig. 4. Deficiency percentage of Micronutrients status in Mayiladuthurai Taluk

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Table. 3. Deficiency percentage of Micronutrients status in Mayiladuthurai Taluk

	Deficiency of Micronutrients (%)			
	Zn	**Cu**	**Fe**	**Mn**
Deficiency of Micronutrients (%)	100	71.42	0.00	42.85
Total number of villages Deficient	7	7	7	7
Total number of villages Sufficient	7	5	0	3

5. 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 and medium fertility status for Phosphorus and Potassium. The values worked out from nutrient Index for Nitrogen, Phosphorus and Potassium were 1.0, 1.80 and 2.22 respectively, against the nutrient index values < 1.5 for low, 1.5 to 2.5 for average and > 2.5 for high fertility status of area. Application of urea to supply nitrogen, superphosphate and DAP to supply phosphorus and potassium sulphate to supply potassium is recommended. Application of 25% extra dose of N,P and K its recommended. Foliar applications of 1% DAP+0.5% urea + 0.5% potash of active filtering and panicle initiation stage is recommended.

Among the four micro nutrients available Fe was sufficiently present in most of the soil samples. Zn, Mnand Cu deficiency were found in soil samples 100%, 42.85% and 71.42%. Zn deficiency accompany 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, utilization of Zn along with organic droppings may enhance the availability and efficiency of native Zn through chelation.71.42% percent deficiency of Cu was recorded. Considerable villages showed deficiency of Cu. These variations in the available Cu content in the whole taluks may be attributed to differences in the topography, texture and organic matter content of soils. In case of coarse textured red sandy soils, soil breeding with clayed.Vertisols may improve the available Cu content by preventing excessive leaching of this micronutrient. High levels of Cu are toxic to the plants as it may produce synergetic and antagonistic effects. Further, the germination percentage of seeds gradually decreases with the increase of Cu concentration.High levels of Cu revealed that indiscriminate use of Bordeaux mixture and other Cu containing fungicides (to grapes and other horticultural crops) over the years might have led to high Cu buildup in soils. Wherever Cu deficiency is noticed in standing crops, 2 to 3 foliar sprays of 0.025% $CuSO_4$ either singly or in combination with other micronutrients may enhance yield and crop growth.

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