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Physico-Chemical Analysis of Different Soil Samples of Thiruvarur District, During the Rabi Cropping Season

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ABSTRACT

For studies of different parameters, such as total organic carbon (OC), nitrogen (N), phosphorus (P) potassium (K), zinc (Zn), iron (Fe), boron (B), pH and electrical conductivity, soil analysis was carried out in the current research. This research leads us to believe that the quantity of soil nutrients in the district of Thiruvarur-Tamilnadu. The results indicate that all Thiruvarur villages have a medium or high mineral content on average. This knowledge would help farmers solve problems related to soil nutrients and determine the amount of fertiliser to be applied to the soil to improve crop yields.

KEY WORDS: PHYSICOCHEMICAL, SOIL, CONDUCTIVITY, ORGANIC CARBON

INTRODUCTION

A series of 15 samples of soil from the villages of the District of Thiruvarur, representing the soil of that village. The soil samples were obtained and gathered in polythene bags by normal procedure. In the summer season, all the samples were collected. These samples were analysed in the laboratory to quantify different chemical parameters using standard methods. (A K Gupta et. al. (1994)) Soil analysis is conducted for studies of different parameters such as total organic carbon, nitrogen (N), phosphorus (P) and potassium (K) pH, pH calculation and estimates of, K+, PO4, NO_3. The soil percentage has been examined. Soil fertility depends on the concentration of N, P, K, organic and inorganic materials, the conductivity of the water and the physicochemical properties needed for the growth of the plant, such as the moisture content, nitrogen as fertiliser. Potassium is used for the purpose of flowering, and phosphate is used for the growth of plant roots (K. Kanimozhi (2011), N.S Sonawane (2013), N N Garba (2013), K.P. Kordlaghari (2013).

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MATERIAL AND METHODS

Study area: The district of Thiruvarur was carved out as a separate district by detaching Valangaiman Taluk from Thanjavur District and Thiruvarur, Nannilam, Kudavasal, Needamangalam, Mannargudi, Thirutturaippoondi Taluks from Nagappatinam District on 01.01.1997. It lies between 10o 20' and 11o 07' North latitude and 79o 15' and 79o 45' East longitude. The total area of the district is 2,377 sq.km.

All the AR grade chemicals and reagents were used. The physicochemical parameter analysis of the soil samples was suspended in distilled water and the particles were allowed to settle down. Using a pH metre (Duralab, India), the suspension pH was determined. The electrical conductivity of the soil was measured using a conductivity metre in the water extract filtrate. By following chromic acid wet digestion method as a standard technique of the Walkley and Black method, the percent organic carbon (OC) content was calculated, available nitrogen was estimated by alkaline permanganate method (K K Borah (2009), I.Ifenna (2013), A F Aiyesanmi (2012)), available phosphorus calculated by volumetric method. Using turbidimetric methods, the available potassium content in the soil was determined (M C Onojake (2012), C C Trasar (2008), K Rajendren (2001), M M Lakdawala (2013).

Figure 1: Study area-Thiruvarur District

RESULTS AND DISCUSSION

pH: A soil pH analysis of the Thiruvarur district samples was calculated for pH and observed within the range (6.60-7.90) of Table.1. Soil sample pH estimate was observed and resulted in a mildly acidic to moderately alkaline reaction (Table.2).

EC (dSm^{-1}) : A research was performed for EC on electrical conductivity (EC) soil samples and observed in the range of (0.25-0.80dSm-1) at 250C (Table.1) in the district of Thiruvarur. EC estimation of soil samples was observed and resulted in the salt-free nature of soil samples (Table.2).

Organic Carbon (OC%) : Data provided in Table.1 analysed for organic carbon from the soil sample observed in the thiruvarur district range of (0.19-0.50) percent (Table.1). The outcome indicates that the soil samples' organic carbon is within the low range (Table.2). High temperatures and good soil aeration have improved the rate of organic matter oxidation by reducing the organic carbon content. The prevailing high temperatures in the region are responsible for the rapid combustion of organic matter, resulting in the low organic carbon content of these soils. Sharma et.al (2008) also noted similar findings.

Table 1. Shows Physicochemical properties of soil samples from villages of Thiruvrur District

S. NO	Samples No	Soil Type	pH	EC (dS m^{-1})	OC (%)	N (Kg ha^{-1})	P (Kg ha^{-1})	K (Kg ha^{-1})	Zn (ppm)	Fe (ppm)	B (ppm)
1	SS1	Riverbed Soil	7.41	0.31	0.25	278	17.6	287	0.68	31.00	41.00
2	SS2	Riverbed Soil	7.20	0.30	0.24	273	19.2	285	0.84	33.50	46.20
3	SS3	Riverbed Soil	7.10	0.33	0.45	275	17.4	288	0.62	30.10	43.40
4	SS4	Riverbed Soil	6.95	0.62	0.50	260	17.6	298	0.40	30.50	50.30
5	SS5	Riverbed Soil	7.11	0.35	0.40	265	16.8	290	0.55	28.50	39.50
6	SS6	Riverbed Soil	7.23	0.60	0.20	278	18.5	272	0.60	33.0	45.30
7	SS7	Paddy field soil	7.35	0.25	0.35	278	18.3	286	0.80	35.00	45.00
8	SS8	Paddy field soil	7.80	0.40	0.28	285	19.0	287	0.75	38.00	38.50
9	SS9	Pond soil	7.90	0.80	0.28	287	20.4	292	0.60	36.50	40.00
10	SS10	Garden soil	7.52	0.25	0.19	280	16.7	282	0.70	36.50	45.40
11	SS11	Barren land soil	7.65	0.43	0.40	280	19.3	290	0.55	30.10	40.20
12	SS12	Garden soil	6.60	0.42	0.40	262	17.6	282	0.68	36.50	44.20
13	SS13	Paddy field soil	6.95	0.55	0.48	271	16.8	259	0.73	37.00	39.00
14	SS14	Cotton field soil	6.95	0.42	0.30	260	19.0	272	0.65	34.20	42.30
15	SS15	Paddy field soil	7.30	0.63	0.40	266	16.6	274	0.75	38.00	37.50

Available macronutrients status of soils:

Available N: The N material available (Table.1) varies between 260-287 Kg ha-1. Taking Table.3 into account the soil test rating for available N (< 250 as low, 250-500 as medium and > 500 as high as N), the soil sample was found to have a medium N content available. By the way, it was found that nearly all soil samples tested for usable N were deficient in N. Although, as suggested by Subbiah and Asija (1956), the available N analysed by the alkaline $KMnO_4$ method is valid.

Available P: In the study area, the available P content in different soils was in the range of (16.6-20.4) Kg ha^{-1} (Table.1). Table 3 displays the soil test ranking of the majority of soils for usable phosphorus (0.10 Kg ha^{-1} as very low, 11-20 kg ha^{-1} as low, 21-40 kg ha^{-1} as medium and > 40 kg ha^{-1} as high). In the available phosphorus, soil samples were observed under low to medium status.

Available K: The results showed that the potassium content available ranged from (259-298) kg ha^{-1} (Table.1). The soils with 0-50 kg ha^{-1} as very low, 51-100 kg ha^{-1} as low, 101-250 kg ha^{-1} as medium and > 250 kg ha^{-1} as high in the potassium content available, are considered in Table.3. Both soil samples were found to be high in usable potassium status.

Available Zn: The Zinc concentration range from 0.40 ppm to 0.80 ppm on all soil samples. The highest Zn content in soil was found in sample SS7. Zinc concentration was found to be below the range of deficiencies in all orchards. The key reasons for zinc deficiencies can be due to the existence of the parent material, the texture of the coarse soil, the low use of organic matter and soil micronutrient fertilizers. Zinc concentration in all areas was found to under deficiencies range. The main reasons for the deficiencies of zinc may be attributed to nature of parent material, coarse soil texture, low use of organic matter and micronutrient fertilizers of our soils.

Available Fe: The average iron in soil was 33.0 ppm. The iron content was significantly higher in SS8 with compare to other samples; it may be due to presence organic matter in soil. Generally, found that the availability of iron increased significantly with increase in organic carbon. The iron content in all the soil samples collected from district of Thiruvarur under high range. This might be due to presence of iron oxide in red soil of the region.

Availability B: Boron content was in the highest range in all regions, showing almost 38-50 pmm, from the results of soil analysis. It clearly demonstrates that the content of boron has exceeded the allowable limits. Usable boron demonstrated a positive and significant correlation The pH, organic carbon and the soil's clay material.

Table 2. Interpretation of soil properties (Reference :MMSOIL-Gov.of India-2011(Methods Mannual et. al. (2011).

Parameters		Interpretation
pH	<4.6	Extremely acidic
	4.6-5.5	Strongly acidic
	5.6-6.5	Moderately acidic
	6.6-6.9	Slightly acidic
	7	Neutral
	7.1-8.5	Moderately alkaline
	>8.5	Strongly alkaline
EC dSm-1	0-2	Salt free
	4-8	Slightly saline
	8-15	Moderately saline
	>15	Highly saline
OC %	< 0.5	Low
	0.5-0.75	Medium
	>0.75	High

Table 3. Permissible limit of the chemical properties.

Properties	Very low	Low	Medium	High
Available Nitrogen in soil (kg ha^{-1})	-	<250	250-500	>500
Available Phasphorus in soil (kg ha^{-1})	0-10	11-20	21-40	>40
Available Potassium in soil (kg ha^{-1})	0-50	51-100	101-250	>250

Source : Soil Plant and Water Analysis [14].

Table 4. Permissible limit of the chemical properties.

Properties	Very low	Low	Medium	High
Available Zinc in soil (ppm)	0-0.5	0.5-1.0	1.0-3.0	3.0-5.0
Available Iron in soil (ppm)	0-2.0	2.0-4.0	4.0-6.0	6.0-10.0
Available Boron in soil (ppm)	0-0.2	0.21-0.6	0.61-1.11	1.2-3.

Source : Soil Plant and Water Analysis [14, 15].

Figuer 2: pH values of all soil samples

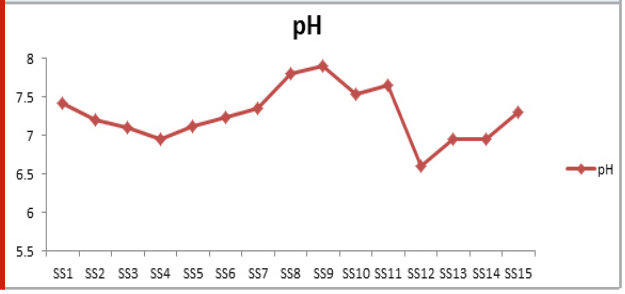


Figure 3. Electrical conductivity values of all soil samples

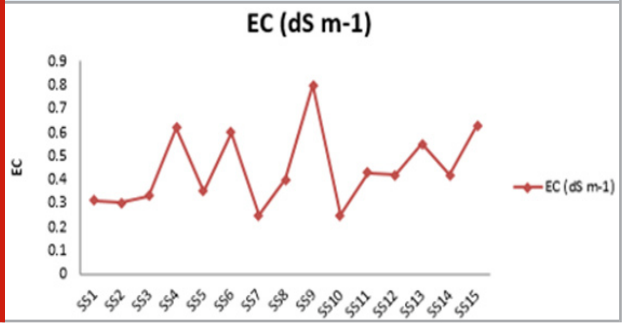


Figure 4: Organic carbon values of all soil samples

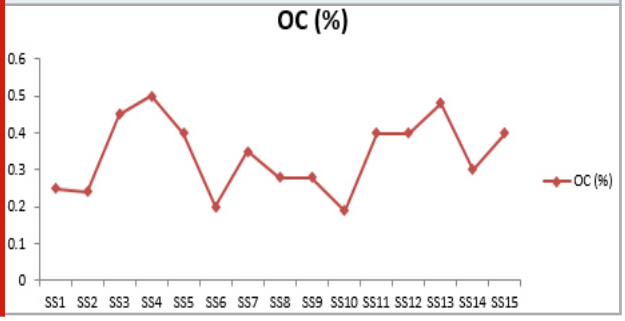
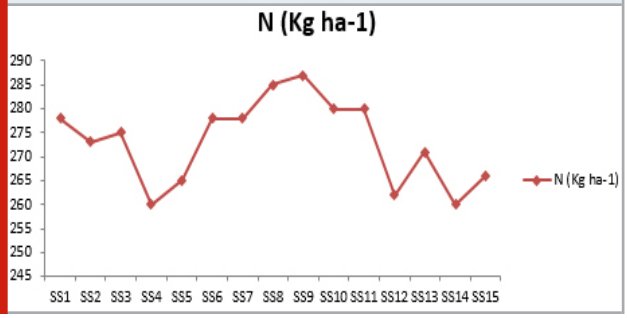


Figure 5: Nitrogen values of all soli samples



CONCLUSION

A physico-chemical analysis of soil samples from 15 villages in the district of Thiruvarur. These studies provide knowledge on the nature of soil nutrients present in the soil. It can be inferred from this analysis that a rich fertiliser is recommended for the available EC, PH, OC, N, P, K, Zn , Fe, B deficient soil. In different regions, the nutrient status

Figure 6: Phosphorus values of all soil samples

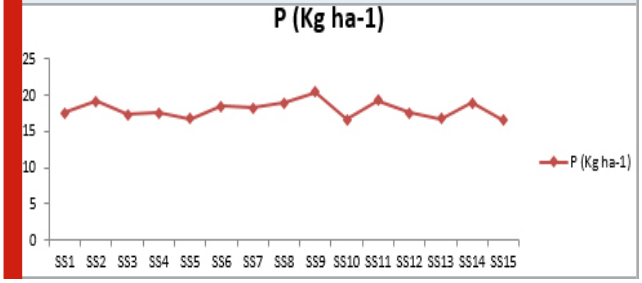


Figure 7: Potassium values of all soil samples

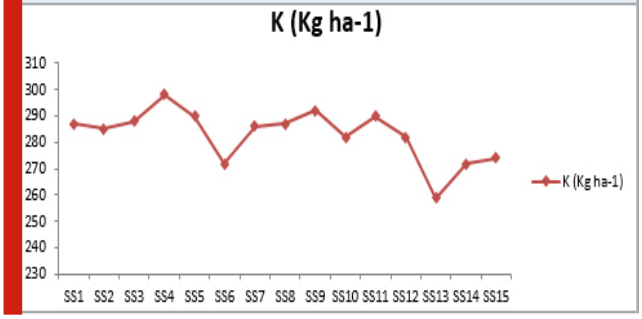


Figure 8: Zinc values of all soil samples

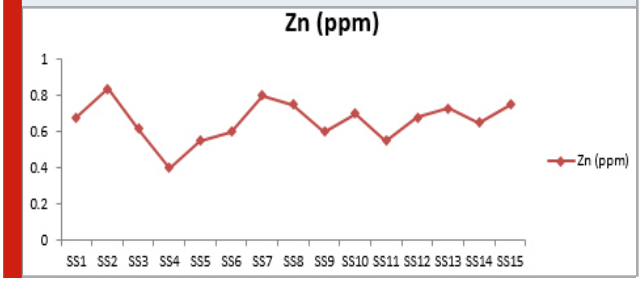


Figure 9: Iron values of all soil samples

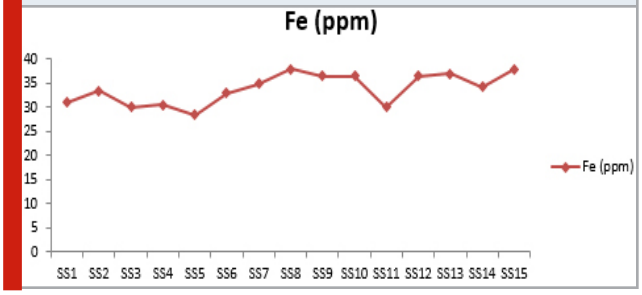
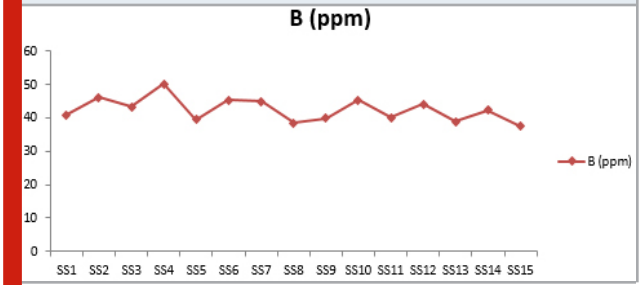


Figure 10: Boron values of all soil samples



also increased the supply of major and micronutrients. Most farmers are using excessive chemical fertilizers from the results of our study, and the excessive dose of such fertilizers in few soils has yielded high P and K values. K retention may also be due to the clay minerals produced by basalt chemical weathering, which is the parent material for the soil. In most soil samples, the values of Fe , Mn and Zn are greater than the normal range, which may be due to poor drainage conditions in this region, which also makes the soil alkaline. For this cause, the use of acidic fertilizers and organic manure can be a solution that can increase crop yield. Farmers arrange the amount of fertilizers and nutrients needed for soil to increase the percentage yield of crops according to this information.

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