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TM Sharmila
Department of Chemistry, Noorul Islam Centre for Higher Education, Kumaracoil, Tamil Nadu, India

S Jerin Jaya Joselin
Department of Chemistry, Noorul Islam Centre for Higher Education, Kumaracoil, Tamil Nadu, India

Correspondence
TM Sharmila
Department of Chemistry, Noorul Islam Centre for Higher Education, Kumaracoil, Tamil Nadu, India

Physico - chemical parameters and fertility status in selected stations of Kanyakumari district

TM Sharmila and S Jerin Jaya Joselin

Abstract
Soil samples are normally prepared for analysis by air drying, sieving and analyzed for various soil fertility parameters. Nutrient management is dependent on the collection and analysis of soil. This study was conducted to evaluate the soil fertility status in four different places. These four samples were collected from the study area. An assessment of variation in physico-chemical parameters of soil like colour, temperature, permeability, pH, electrical conductivity, concentration of macronutrients such as N,P,K and trace elements such as Fe, Mn, Zn and Cu were undertaken in Kanyakumari district. The available macronutrients were analyzed by quantitative analysis, calorimetric analysis and flame photometer respectively. The available trace elements concentration was determined by using Atomic Absorption Spectrometer. The data on various parameters were categorized into low, medium and high classes based on soil fertility ratings. The quantification of changes in soil nutrients stock is crucial to identify problematic land use system. The indicator for the soil nutrient balance combines this rate of soil nutrient change and the soil nutrient stock.

Keywords: Macro nutrients, trace metals, parameter, nutrient, concentration

1. Introduction
Soil fertility is the inherent capacity of the soil to provide the essential plant nutrients in adequate amounts and in proper proportions for the plant growth [1]. Soil characterization of a region is an important aspect in relation to sustainable agricultural production. The macronutrients and micronutrients are an important soil element that control its fertility and enhances the yield of crops [2]. The soil quality analysis includes an analysis of parameters and processes which effects on soil to operate efficiently as a component of a sound ecosystem [3]. The quality of soils does not depend on its ability to supply adequate nutrients alone but the nutrients must be in the right proportion as needed by plants [4]. The anthropogenic changes in land use have altered the characteristics of the Earth's surface, leading to changes in soil physico-chemical properties such as soil fertility, soil erosion sensitivity and content of soil moisture. These changes may be caused by soil compaction that reduces soil volume and consequently lowers soil productivity and environmental quality [5]. Maintenance or enhancement of soil quality is a more important criterion for analysis and sustainability of soil ecosystems [6]. Soil fertility plays a key role in increasing crop production in the soil. It comprises not only in supply of nutrients but also their efficient management. The fertility status of soil indicates their nutrient supplying capability. The most important constituents in soil is organic matter, an appreciable amount of organic matter in soil tremendously increase soil fertility [7].
Soil test based nutrient management has emerged as a key issue in efforts to increase agricultural productivity and production since optimal use of nutrients, based on soil analysis can improve crop productivity and minimize wastage of these nutrients, thus minimizing impact on environmental leading to bias through optimal production. Deficiencies of primary, secondary and micronutrients have been observed in intensive cultivated areas [7].
Soil investigation work included soil sampling, site testing and laboratory testing. Laboratory testing work included physical and chemical properties of soil test. The purpose of soil classification, field and laboratory testing is to ascertain the colour, moisture, temperature, texture, permeability and consolidation characteristic of soils encountered. Soil samples were tested for pH., electrical conductivity, micro and macronutrients. Soil studies learn to identify, interpret, manage soils for agriculture, forestry, ecosystem and urban uses.

2. Methodology

2.1 Study Area

Kanyakumari is one of the smallest district in Tamil Nadu state having an area of 1584 km^2. The district lies between 77° 05' and 77° 36'of the Northern latitude. The soil samples were collected from Nagercoil, Chunkakadai, Villukuri, Marthandam,

2.2 Sampling

Nagercoil, chunkakadai, villukuri and marthandam, were selected as sampling locations. At each sampling location, about 2 kg of soil was collected at the surface levels (0-15 cm in depth) at a distance 1 m away from the road. Soil samples were prepared by collecting small portions of surface soil. A"V" shaped cut of 0-6 inch depth at random locations was made in each sampling site, and one inch of soil on either side of pit was scraped and collected in polythene bags. Quartering technique was adopted to reduce the size of the sample to the required mass. The collected soil samples are then assigned with identification number and were processed, analyzed by selecting standard procedures which are appropriate for soils of the study area. The samples were collected in each sampling point, crushed and sieved with 2 mm mesh before storing it in labeled polythene bags before analysis.

2.3 Determination of physical parameters

The soil samples were dried and grinded more finely. Physico-chemical parameters and nutrients of four soil samples were determined and results were also recorded. During collection, temperature of the sample was recorded.

- Determination of moisture by weighing balance.
- Determination of pH by Electronic pH meter.
- Determination of electrical conductivity by Conductometer.
- Determination of Nitrogen (N) and Phosphorous (P) by Titration method.
- Determination of potassium (k) by Flame photometry.
- Determination of trace elements (Fe, Cu, Zn, Mn) by Atomic Adsorption Spectrometry.

3. Results and Discussion

Table 1: Status of Physical and chemical Parameters of soil samples of four stations

S. No	Parameters	Sample 1	Sample 2	Sample 3	Sample 4
1.	Color	Brown	Brown	Black	Black
2.	Permeability	Good	Good	Good	Medium
3.	Temperature	25.36	27.60	26.71	29.66
4.	Moisture	2.08	1.15	3.40	2.89
5.	Ph	6.6	6.1	6.3	6.8
6.	Electrical Conductivity	0.27	0.15	0.12	0.04
7.	Nitrogen(Kg/Hect)	35	35	56	57
8.	Phosphorous (Kg/Hect)	6.95	5.14	6.05	8.75
9.	Potassium (Kg/Hect)	75.9	39	26.05	56.5
10.	Iron (Ppm)	4.30	4.64	6.30	3.04
11.	Manganese (Ppm)	2.22	2.25	1.90	3.64
12.	Zinc (Ppm)	0.53	0.53	1.12	0.64
13.	Copper (Ppm)	0.52	0.54	0.34	0.76

3.1Colour

The soil sample 1 & 2 is brown in colour and sample 3, 4 is black in colour.

3.2 Permeability

The soil sample 1, 2, 3 is good permeability and sample 4 is medium permeability.

3.3 Temperature

The temperature range of four soil samples are 25.36ºC, 27.60 ºC, 26.71 ºC, 29.66 ºC.

3.4 Moisture

Moisture value ranges from 1% to 6%.

3.5 pH

Soil samples 1, 2, 3, 4 showed neutral and very slightly acidic.

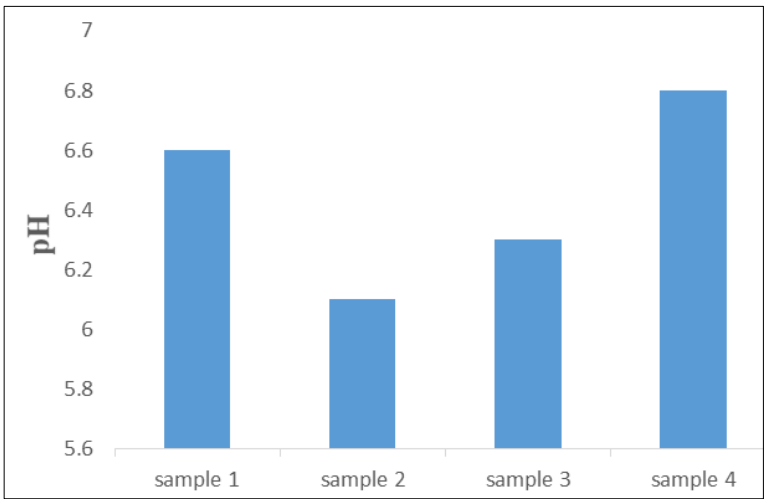

Fig 1: The values of pH in different four soil samples

3.6 Elecrical conductivity

In the determined data of electrical conductivity, all soil samples have good value. So the salt content of the soil is less and will not affect plants.

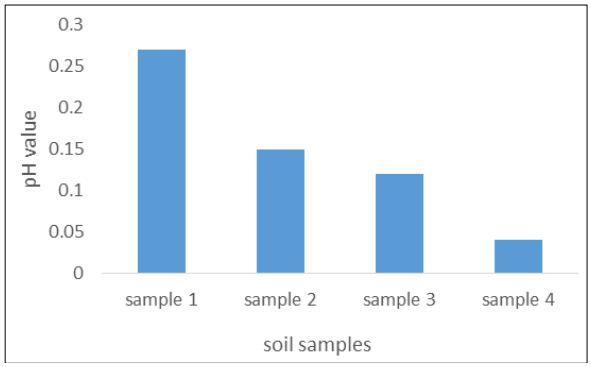

Fig 2: Variation of electrical conductivity value in different soil samples

3.7 Nitrogen

All soil sample data showed a low value of available nitrogen in soil and it is showed a deficiency of nitrogen. Nitrogen deficiency symptoms in plants are stunted in growth, shorter, internodes and small pale yellow leaves. Plants may become light green. To overcome this deficiency, it is necessary to add nitrogen containing fertilizer to enrich the soil.

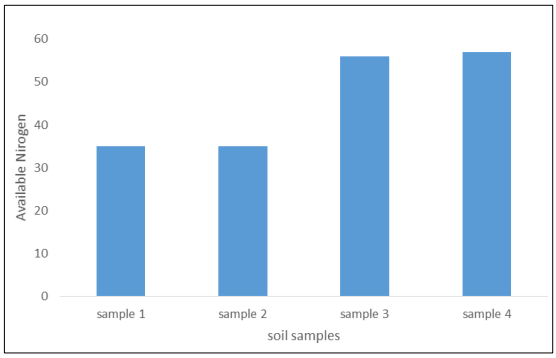

Fig 3: The mean concentration of macronutrient (Nitrogen)

3.8 Phosphorous

The phosphorous value for the fourth sample is 8.75.This value is nearer to high phosphorous value but other three samples have medium phosphorous value. Its deficiency causes disturbance in the nitrogen metabolism of plants. This deficiency can be managed using animal manures, rock phosphate and ammonium phosphate to soil.

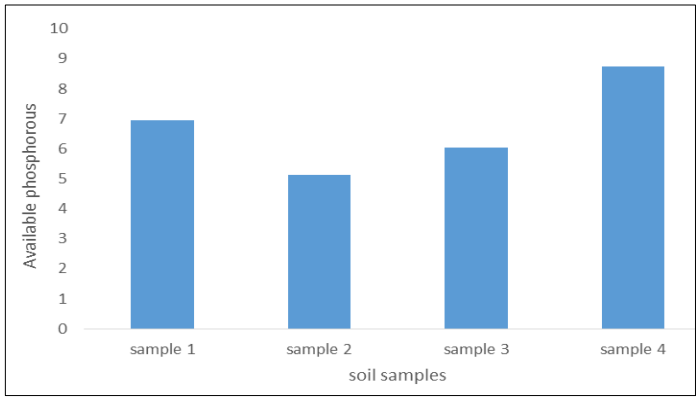

Fig 4: The mean concentration of macronutrient (Phosphorous)

3.9 Potassium

Soil sample 1,4 showed medium levels of available potassium. Samples 2,3 showed low levels of available potassium. Potassium is an essential plant nutrient and is required in large amounts for proper growth and reproduction of plants. Potassium is considered as the "quality nutrient." Plants absorb potassium in its ionic form, K^+. Potassium deficiency causes cholrosis, slow or stunted growth, and poor resistance to temperature changes and to drought**,** defoliation. Potassium deficiency also causes poor resistance to pests, weak and unhealthy roots, uneven ripening of fruits. Potassium deficiency can be managed by adding potassium-specific fertilizer, often called potash, which consists of K_2CO_3.Rock potash may be a good solution because it has high potassium content but is released slowly to reduce overdose. Common forms of inorganic fertilizers include potassium nitrate, potassium sulphate and mono potassium phosphate.

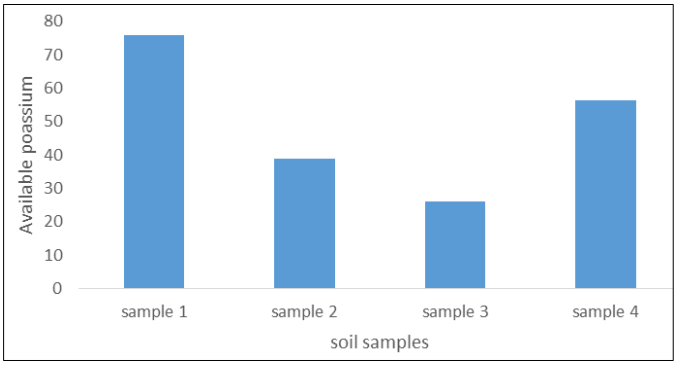

Fig 5: The mean concentration of macronutrient (potassium)

3.10 Trace elements (Iron, Manganese, Zinc and Copper)
It was observed that the medium critical value concentration of Iron in sample 1,2,3,4, In sample3 have below critical value concentration of Manganese and remaining samples have above critical value. The concentrations of Zinc have low value in sample 1, 2, 4 and sample 3 have high concentration value. The concentration of copper have low value in all samples. Copper is an important nutrient for many soil microbes. It controls, moulds and often alleviates perceived Zn deficiencies. It plays a vital role in root metabolism and helps to form proteins, amino acids and is a host of organic compounds. It acts as a catalyst or form part of the enzyme systems. To get rid of this deficiency, it is needed to add sufficient amount of copper sulphate to soil.

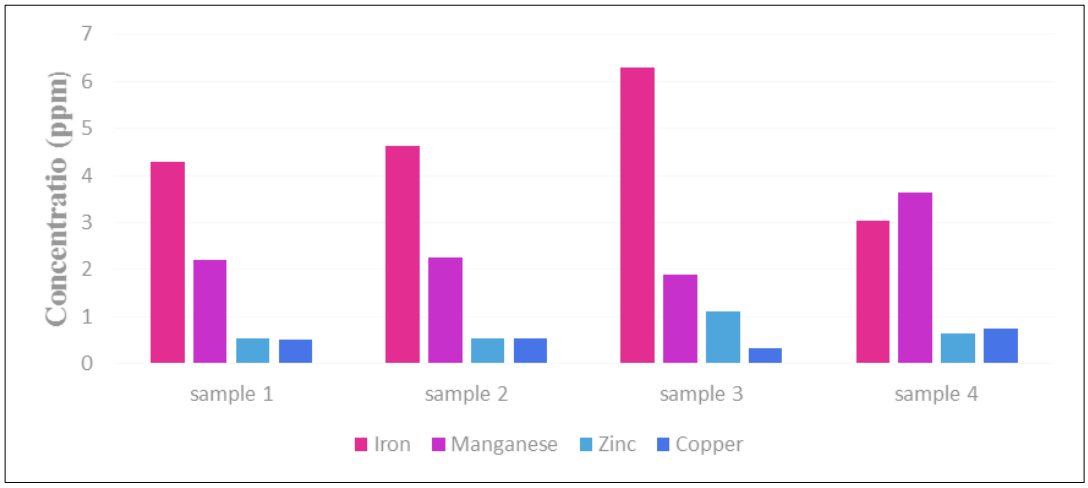

Fig 6: Trace metal values of different soil samples

4. Conclusion

Soil samples were collected from Nagercoil, Marthandam, Villukuri and Chunkankadai. Physical and chemical parameters were analyzed. The pH value shows that the soil is slightly acidic and it is suitable for cultivation of Banana, Rubber and Coconut. The value of electrical conductivity is good and it is a measure of the amount of salts in soil. Comparing the physical parameters, chemical parameters and available macro and micro nutrients of station 1 and 2, station 2 soil is better for rubber cultivation than station 1. Likewise station 3 is better than station 4 to the cultivation of banana plant.

With the knowledge and experience gained in this study, practical field analysis techniques for determination of some of the soil nutrients, elements in water may be developed in the future, so that the chemical and physical properties of soil and water could be tested easily by the farmers in the field. This will help them to get better quality produce, with high yield and results in soil and water conservation and better environmental protection.

5. Acknowledgement

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