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INVESTIGATION OF ESSENTIAL MICRONUTRIENTS LEVELS IN VARIOUS LATERITE SOILS FROM KANYAKUMARI DISTRICT, TAMIL NADU

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ABSTRACT

Purpose

In the present study, the levels of some essential micronutrients (Fe, Co, Zn and Cu) were determined in the laterite soils located in Kanyakumari district, Tamil Nadu. The aim of the present work is to assess the levels of micronutrients like Iron, Copper, Zinc and Cobalt in soils and analyze the aptness of the soil for crop production.

Methodology

The soils were processed and analyzed for these metals using atomic absorption spectrophotometer.

Findings:

The results showed that the levels of Fe were higher (146.98mg/kg) in soils obtained from Munchirai(S1). This trend was followed by Cu with the highest amount (25.65mg/kg) determine at Melpuram(S2). Similarly, Zn and Co had their highest levels (96.76 mg/kg Zn, 21.08 mg/kg Co) in soils obtained from Thuckalay(S5) and Melpuram(S2) respectively.

Implications

These study revealed that the accumulation of these micronutrients depended not only on the availability of these metals in the five stations but also on other factors which were not considered in the study.

Originality

The study was done in the Department of Chemistry, Sree Devi Kumari Women's College, Kuzhithurai, TN, India

Keywords: *Micronutrients, laterite soil, and atomic absorption spectrophotometer, Kanyakumari*

INTRODUCTION

The word micronutrient refers to the relative quantity of a nutrient which is required for plant growth. It does not mean that they are less important to plants than other nutrients like macronutrients, secondary nutrients, etc. As minerals dissection during soil formation, micronutrients are gradually released into the soil in the form that is available to plants.

The micronutrients like Fe, Cu, Zn, Mn, Co, Ni, Mo, and S in soil play a vital role in plant growth, production and soil lushness (Gupta U.C., Kening W. and Siyuan L. (2008). The main roles of the micronutrients in the living organism are structural components of cell constituents and its metabolically active compounds, in the conservation of cellular organization, in energy transformation, etc. (Renwick, A.G. and Walker, R. (2008). The boost in nutrient supply beyond a certain limit resulting in the decreased yield of plants is often be linked with the production of particular toxic effects. (Fageria, N.K., Baligar, V.C. and Clark, R.B. (2002).

The usual badland fallow system is gradually giving way to intensive land cultivation with the use of NPK fertilizers. There is an equal demand for soil micronutrients, which incidental input through major micronutrient fertilizer application is unable to survive with the plant requirements (Heathcoke and Stockinger, (1990).

The aim of the present work was to assess the levels of micronutrients like Iron, Copper, Zinc and Cobalt in soils and analyses the aptness of the soil for crop production.

MATERIALS AND METHODS

Study Area

Kanyakumari District is the southernmost district in Tamil Nadu state and mainland India. The district lies between 77º 15' and 77º 36' of the eastern longitudes and 8º 03' and 8º 35' of the Northern Latitudes. The District is bound by Tirunelveli District on the North and the East. The South Eastern boundary is the Gulf of Mannar. On the South and the South West, the boundaries are the Indian Ocean and the Arabian Sea. On the West and North West, it is bound by Kerala. (Falling rain Genomics. Inc- Kanyakumari). In Kanyakumari District Laterite soil is found at Thiruvattar, Killiyoor, Munchirai, Rajakamangalam and Thuckalay blocks.

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Sample Collection

The soil samples were collected during Oct 2014 to Sep 2015 from five stations (Munchira, Melpuram, Killiyoor, Rajakamangalam and Thuckalay) representing the study area (Figure no 1). The stones, pebbles and roots were removed, and the samples were dried at 50°C in an oven. For the analysis of micronutrients, the samples were ground well using a mortar and pestle. 1.0 g of each ground sample was allowed to rest overnight in a mixture of 4.5 ml concentrated HNO3 and 1.5 ml Hcl at room temperature in the closed Teflon vessels. Then the samples were digested under pressure at150uC for 3 hours. The digested samples were cooled, quantitatively filtered with pre-cleaned filter paper and the volume was made up to 25 ml with double distilled water. Samples were analyzed using Atomic Absorption Spectroscopy.

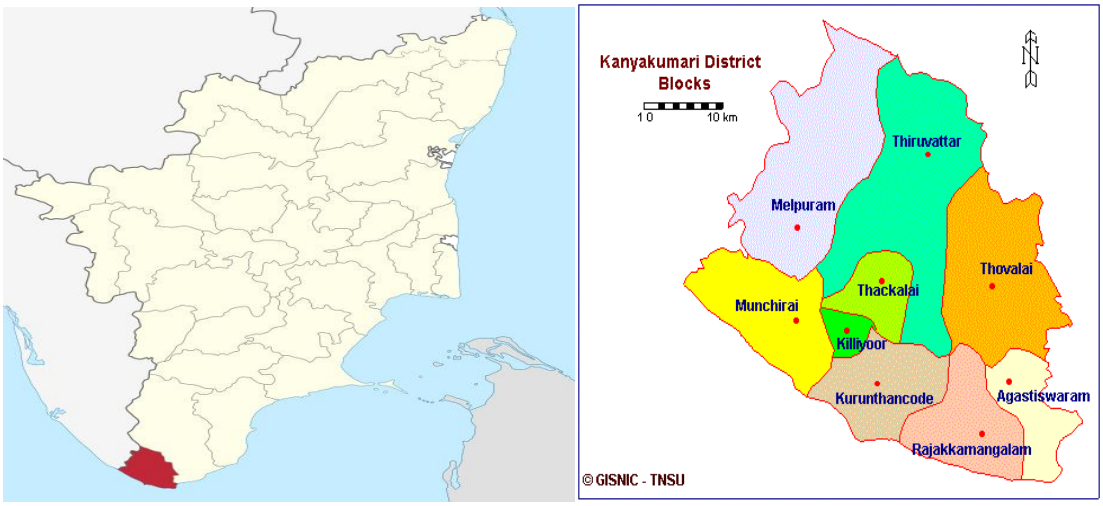

Figure no 1: Maps representing location sites

RESULT AND DISCUSSION

Iron

The results of soil Iron during the period of study are represented in Chart-I. The maximum value of Iron at Munchirai(S1) was 146.98 mg/kg (Mar 2015), Melpuram(S2) was 128.19 mg/kg (Jun 2015), Killiyoor(S3) was 79.05 mg/kg (Mar 2015), Rajakamangalam(S4) was 31.98 mg/kg (Jun 2015), Thuckalay(S5) was 120.54 mg/kg (Nov 2014). The highest value throughout the year was observed at Munchirai(S1) 146.98 mg/kg (Mar 2015), and the minimum was founded at Rajakamangalam(S4) 24.98mg/kg (Feb 2015).

In the present study, the concentration of Iron was higher than that was reported by Oskwe, (2014), Ajibola and Oziyis (2005). Iron concentration is found to be the highest in the study areas, and it has been confirmed that natural soils contain a significant amount of Iron (Ademoroti,(1996), Aluko and Oluwande,(2003). Most of the iron in soils are in the form of Iron peroxides.

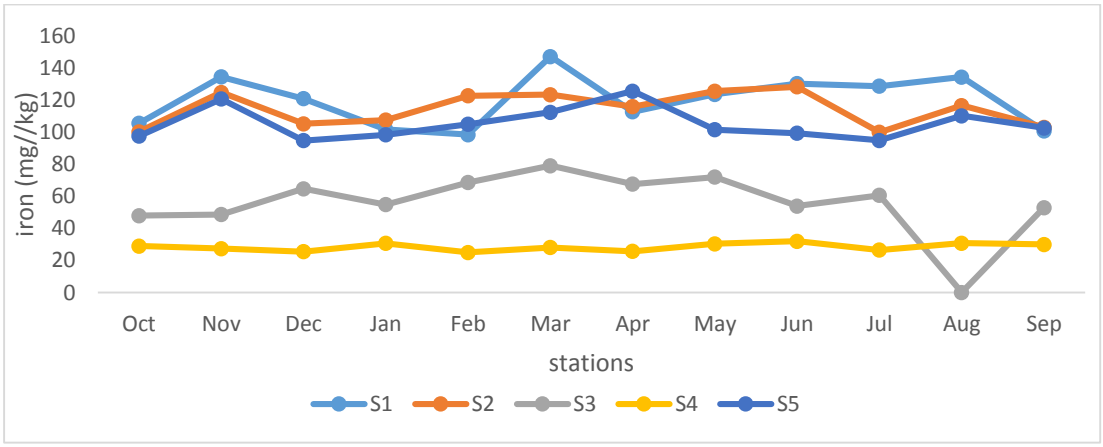

Chart-I Level of iron

Copper

The results of soil Copper during the period of study are represented in Chart-II. The maximum value of Copper at Munchirai(S1) was 19.68 mg/kg (Apr 2015), Melpuram(S2) was 25.65mg/kg (Dec 2014), Killiyoor(S3) was10.21mg/kg (Jun 2015), Rajakamangalam(S4) was 1.51 mg/kg (Oct 2014), Thuckalay(S5) was 20.65 mg/kg (Sep 2015). The highest value throughout the year was observed at Melpuram(S2) 25.65mg/kg (Dec 2014), and the minimum was founded at Rajakamangalam(S4) 0.43mg/kg (Sep 2015).

In soil Copper is available in the form of dissolved state. So it enters into the nearby water bodies easily. The micronutrients like Copper, Zinc have known functions as heavy metals, they can be toxic at higher concentrations (Sharma C.P (2006). But in the present study, the concentration of Copper is in the safer limit. So it functions as a micronutrient.

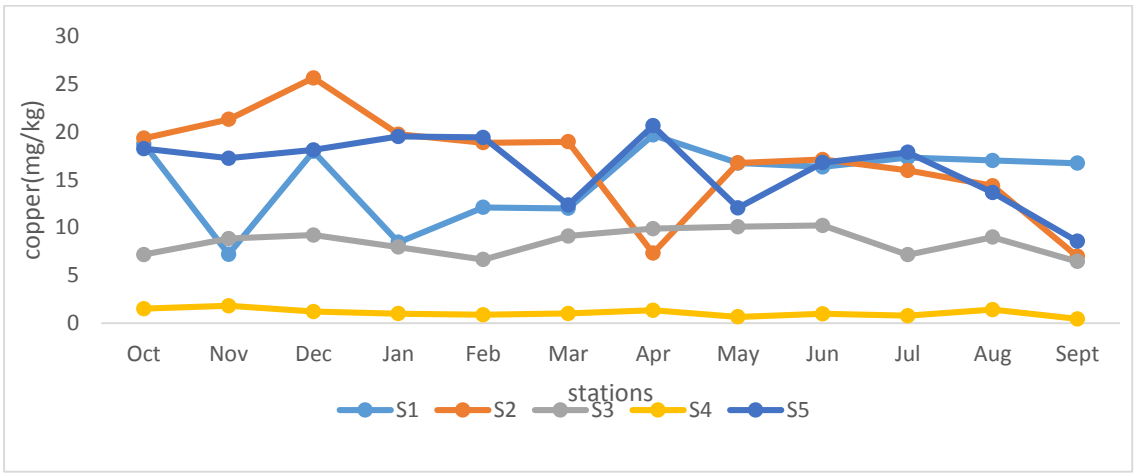

Chart-II Level of copper

Cobalt

The results of soil Cobalt during the period of study are represented in Chart-III. The maximum value of Cobalt at Munchirai(S1) was 19.13 mg/kg (May 2015), Melpuram(S2) was 21.08 mg/kg (Mar 2015), Killiyoor(S3) was 12.65 mg/kg (May 2015), Rajakamangalam(S4) was 14.86 mg/kg (Jun 2015), Thuckalay(S5) was 17.68 mg/kg (May 2015). The highest value throughout the year was observed at Melpuram(S2) 21.08 mg/kg (Mar 2015), and the minimum was founded at Rajakamangalam(S4) 4.80mg/kg (Nov 2015).

The average total Cobalt concentration in the earth's crust is 40mg/kg (Rudnick, R.L. and Gao, S. (2003). The available and total concentration of Cobalt in soils of this region were varied from 4.80mg/kg- 21.08 mg/kg. Considering the 4.8 mg/kg as the critical limit for Co deficiency in soil, besides this almost all soils from this region may be rated as contaminated with sufficient level of Co for plant growth.

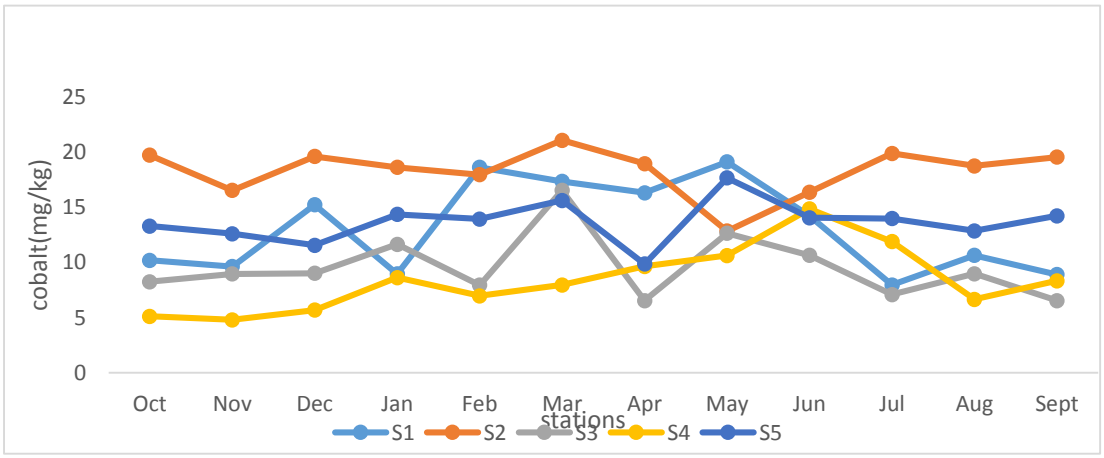

Chart-III Level of Cobalt

Zinc

The results of soil Zinc during the period of study are represented in chart-IV. The maximum value of Zinc at Munchirai(S1) was 89.16 mg/kg (Sep 2015), Melpuram(S2) was 96.76 mg/kg (May2015), Killiyoor(S3) was 80.99 mg/kg (Aug 2015), Rajakamangalam(S4) was 62.77 mg/kg (Jul 2015), Thuckalay(S5) was 60.67 mg/kg (May 2015). The highest value throughout the year was observed at Melpuram(S2) 96.76 mg/kg (May 2015), and the minimum was founded at Rajakamangalam(S4) 50.87mg/kg (Feb 2015).

Zinc is one of the micronutrients essential for plant growth (Jung, (2008). The higher concentration of Zinc is due to the heavy traffic zones, fragmentation of car tyres, etc.

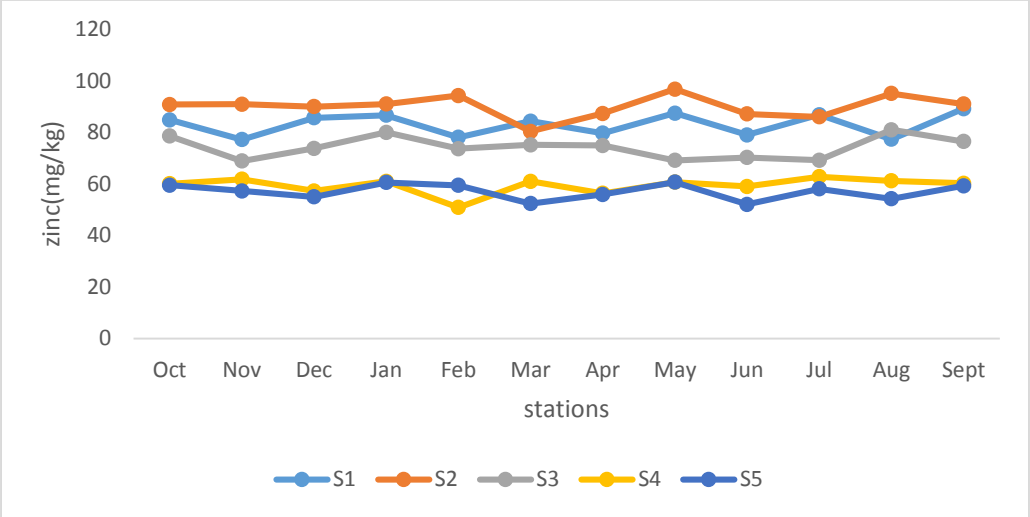

Chart-IV Level of Zinc

SUMMARY AND CONCLUSION

The amounts of the micronutrients (Zn, and Co, Cu) were found to be higher at Melpuram(S2) while compared with their corresponding levels in the soils obtained at the other four stations. But the amount of micronutrient Fe was found to be higher at Munchirai(S1) when compared with its corresponding levels in the soils obtained at the other four stations. On comparing the values, Melpuram(S2) is apt for cultivation. It is important to state that soils obtained from the five stations should be properly screened or assessed for the presence of essential micronutrient elements before being used for the cultivation of crops.

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