

Full Length Research Paper

Status of micronutrients in rhizosphere soils of Thanjavur District, Tamilnadu, India

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Accepted 24 July, 2015

The micronutrient status of rhizosphere soils of Thanjavur district, Tamilnadu was made at 9 different locations. The objective of the present study was to analyze the status of micronutrients and their relationship with various physicochemical properties. Soil samples were collected at a depth of 0-30cm and analyzed zinc (Zn), copper (Cu), iron (I) and manganese (Mg). The Zn, Cu, I and Mg ranged from 0.56 - 0.96, 0.57 - 0.96, 4.16 - 5.36 and 2.03 - 2.65 mg/kg⁻¹ respectively. Nutrient management is an integral part of profitable agrisystems, but in some areas of Tamilnadu inputs of fertilizer and manure nutrients in excess of crop requirements have led to a buildup of nutrient concentrations that are of environmental concern. There is an increasing awareness of the need to pay greater attention to the role of trace elements in plant nutrition as we seek to explain the adverse effects of deficiencies and toxicities, and avoid suboptimal concentrations that limit the attainment of optimum economic yields of crops. But some elements can accumulate even as traces to concentrations that are toxic to the plant. For example, plant growth is adversely affected by excess manganese (Mn) and aluminium (Al) in many soils if they are allowed to become acid, or by nickel (Ni), cobalt (Co) or chromium (Cr) in acid soils derived from minerals in which there is a natural abundance of these elements. In other soils, concentrations of trace elements have increased as a consequence of human activity and such pollution often results in increased plant uptake with adverse effects on humans, as for example with cadmium (Cd). In these cases it is essential to ensure that the concentration of the element in the soil solution does not exceed an agreed critical value.

Key words: Rhizosphere soil, physico-chemical properties, micro nutrients, agricultural field.

INTRODUCTION

Soil fertility is an important factor, which determines the growth of plant. Soil fertility is determined by the presence or absence of nutrients i.e. macro and micronutrients. Out of the 16 plants nutrients, Zn, Cu, I, Mg, Mo, Cl and B are referred as micronutrients. These elements are required in minute quantities for plant growth, but have the same agronomic importance as macronutrients have and play a vital role in the growth of plants. Micronutrients also increase plant productivity,

leaf and grain yield. Most of the micronutrients are associated with the enzymatic system of plants. Whenever a micronutrient is deficient, the abnormal growth of plant results which sometime cause complete failure of crop plants. Grains and flower formation does not take place in severe deficiency. The main sources of these micronutrients are parent material, sewage sludge, town refuse, farmyard manure (FYM) and organic matter. These nutrients are present in small amounts ranging from few mg kg⁻¹ to several thousand mg kg⁻¹ in soils (Rajkumar *et al.*, 1996).

The availability of micronutrients is particularly sensitive

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to changes in soil environment. The factors that affect the contents of such micronutrients are organic matter, soil pH, lime content, sand, silt, and clay contents revealed from different research experiments. There is also correlation among the micronutrients contents and above-mentioned properties (Sheeja *et al.*, 1994).

The total area under cultivation of Thanjavur district of Tamilnadu is approximately 1,50,000 hectares. The major crops cultivated are rice, coconut and casuarinas while minor crops include gram, pulse, oil seed and vegetables. Thanjavur district divided into seven administrative Taluks namely; Thanjavur, Pattukkotai, Peravurani, Orathanadu, Kumbakonam, Pabanasam, Thiruvaiyaru and Thiruvaidaimarudhur. The soils of this region are generally used for rice, coconut, vegetables and crop production. The objective of the present study was to determine the physical and chemical properties of rhizosphere soil from various locations of Thanjavur district, Tamilnadu.

MATERIALS AND METHODS

Sample collection

In the present study, the soil samples were collected from eight different locations of Thanjavur district, Tamilnadu namely Kurichy, Ettupulikkadu, Kanniyakurichy, Thuravikkadu, Punalvasal, Ulur, Pappanadu, Cholankudikadu and Ambalapattu. Soil samples were collected from rhizosphere zone of *Casuarina* plant in sterile containers. Four to six pits were dug for each sampling station at a depth 0-30cm. A composite sample of about 1kg was taken through mixing of represented rhizosphere soil sample. All composite samples were dried in shade condition and passed through 2mm sieve. After sieving all the samples were packed in sterile polythene bags for laboratory investigations.

Analysis of Soil physico-chemical properties

The Zn, Cu, I and Mg were determined using the standard method given by Havlin and Sultanpour (1981). Rhizosphere soil pH was determined in 1:5 (soil: water) suspensions (U.S.D.A. Hand Book, 1954). Organic matter was determined by the methods of Walkely. Lime content was determined by acid neutralization method (Black, 1965). Rhizosphere soil texture was determined by hydrometer method (Koehler *et al.*, 1984).

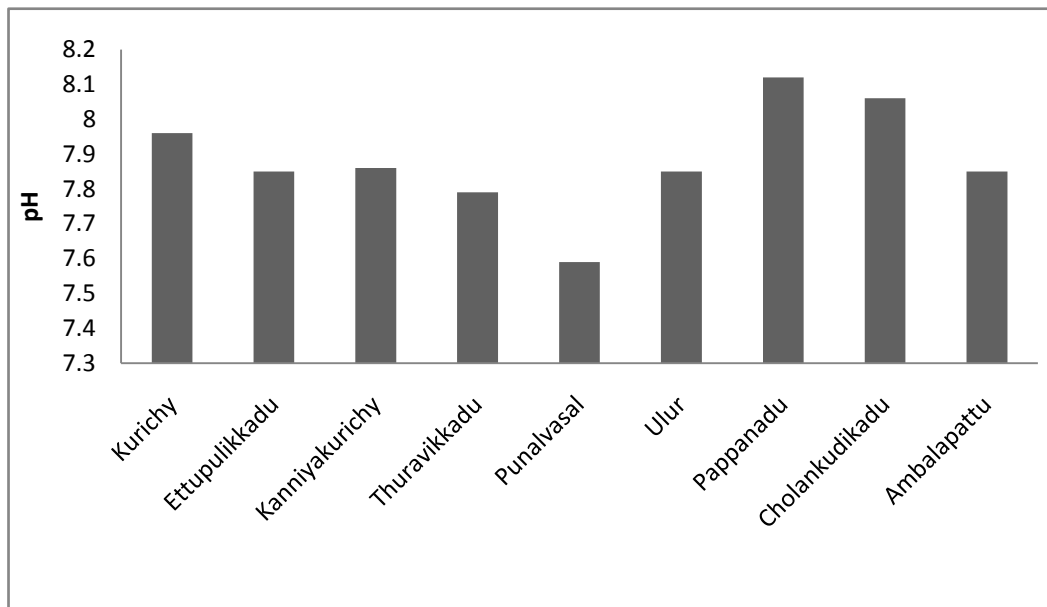
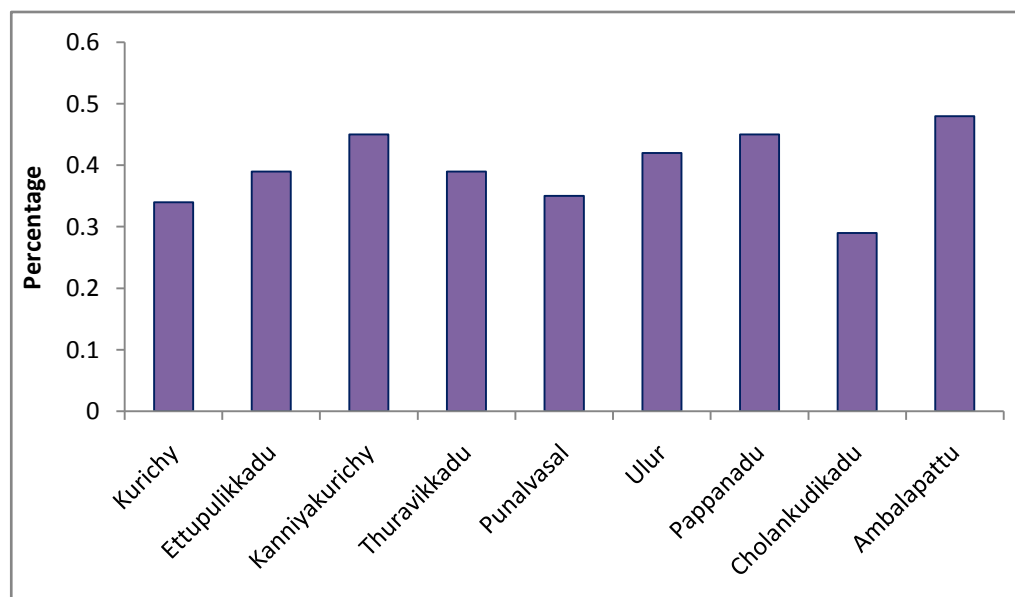
RESULTS AND DISCUSSION

Thanjavur district of Tamilnadu has deep and fertile soils. It can be grouped into two categories namely 1) alluvial soil and 2) lateritic soil. Alluvial soil is found to occur in

the old delta region comprising the major portion of the zone lying in the northern part whereas, lateritic soil covers new delta region lying in the southern part of the district. The alluvial soils are clayey in texture with 40 - 45 per cent clay fraction (Cauvery Delta Zone – Status Paper; Proper Literature not found). In the present study, edaphic factors results (Figure 1) showed that the rhizosphere soils of Thanjavur district were alkaline in nature. The maximum soil pH (8.12) was recorded at Pappaandu, whereas minimum pH (7.59) was recorded at Punalvasal soils. The present study also recorded average pH of the rhizosphere soil as 7.88 from eight locations of Thanjavur district.

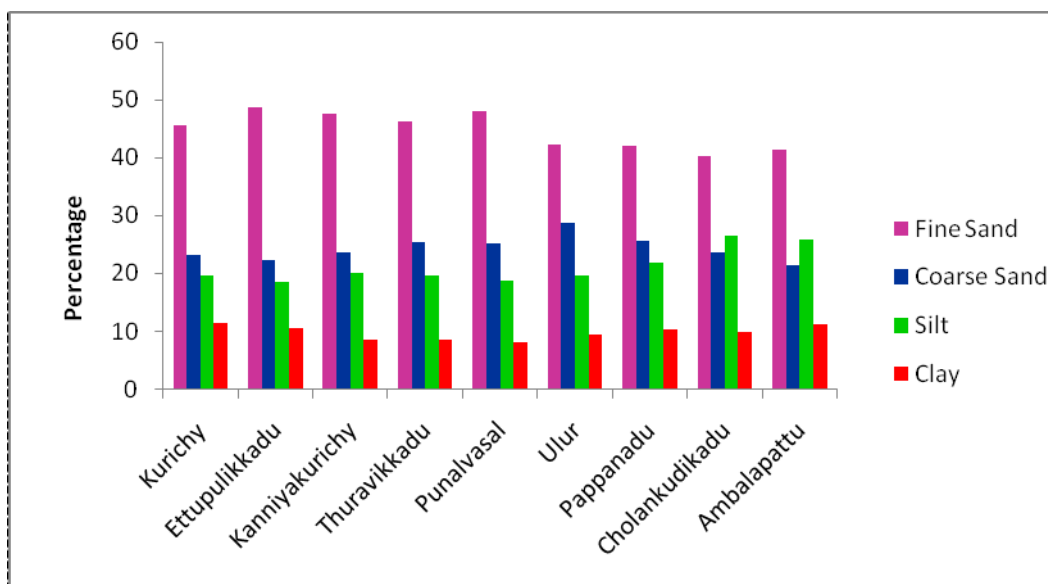
The maximum organic matter of the soil was (0.48%) recorded at Ambalapattu, whereas minimum (0.29%) was recorded at Cholankudikadu soils (Figure 2). The average organic matter content of the soil was as 0.39%. The maximum fine and course sand contents of the soil were recorded from Ettupulikkadu (48.62%) and Ulur (28.65%) respectively. Further, the average fine and course sand contents of the soil were 44.72% and 24.33% respectively. The silt and clay content of was maximum in Cholankudikadu (26.41%) and Kurichy (11.51%) respectively (Figure 3). The average silt and clay content of the rhizosphere soil was 21.16% and 9.77% respectively. Similar type of work has been reported by many workers physico - chemical properties of the rhizosphere soil of the *Curcuma longa* L. was analyzed by Sumathi *et al.* (2008); rehabilitated and secondary forests soil physico – chemical properties by Akbar *et al.* (2010).

In addition, most of the rhizosphere soils of the present study were appeared blackish brown in colour and texture was sandy clay loam in nature. The lime content of the soil was present only in Pappanadu and Cholankudikadu. The heavy metals (ppm) also present in all the eight sampling stations (Table 1). The *Casuarina* rhizosphere soils were also analyzed for its micronutrients such as available Zn, Cu, I and Mg. The maximum content of available Zn (0.96 ppm), Cu (0.96 ppm), I (5.36 ppm) and Mg (2.65 ppm) was recorded in rhizosphere soils of the Punalvasal, Kanniyakurichy, Cholankudikadu and Ambalapattu respectively (Figure 4). Similarly, Perveen *et al.* (1993) studied micronutrient status of some agriculturally important soil series of the Northwest Frontier Province, Pakistan and their relationship with various physico-chemical properties for 30 soil series. Most sandy soils (coarse texture) are deficient in micronutrients. Clay soils (fine texture) are not comparatively to be low in plant available micronutrients. Chhabra *et al.* (1996) studied that available Mg and I decreased with soil pH and available Cu increased with clay and organic carbon content and available I decreased with sand content. Hence, the correlation coefficient analysis between the soil physico-chemical parameters and microbial population of rhizosphere soils of crop plant have suggested as future course work.

Figure 1. Variations of soil pH in the rhizosphere of *Casuarina*.**Figure 2.** Variations of soil organic matter in the rhizosphere of *Casuarina*.

Soil fertility is an important factor, which determines the growth of plant. Soil fertility is determined by the presence or absence of nutrients i.e. macro and micronutrients. A basic soil test will provide information on soil texture, organic matter, pH, buffer index, phosphorus, potassium and nitrate. Most of the soil tests will give a range for the nutrients, such as low, medium

and high, to give an indication of relative amounts of nutrients in the soil. When a nutrient is in the low range, it means that added inputs of that nutrient will likely show a strong growth response in the next crop planted. A conventional soil laboratory will provide fertilizer recommendations based on the next crop. On the whole, it was reported that the physico – chemical properties of

Figure 3. Variations of soil texture in the rhizosphere of *Casuarina*.**Table 1.** Variations in the structure of rhizosphere soils of *Casuarina*.

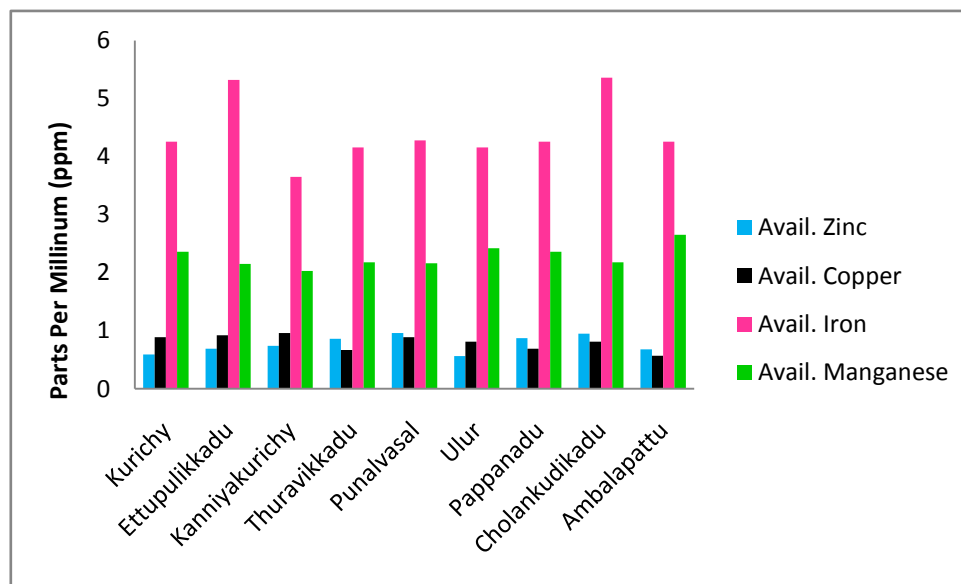
Parameter	Kurichy	Ettupulikkadu	Kanniyakurichy	Thuravikkadu	Punalvasal	Ulur	Pappanadu	Cholankudikadu	Ambalapattu
Colour	Blackish Brown	Blackish Brown	Blackish Brown	Blackish Brown	Blackish Brown	Blackish Brown	Blackish Brown	Blackish Brown	Blackish Brown
Texture	Sandy Clay	Sandy Clay Loam	Sandy Clay Loam	Clay Loam	Sandy Clay Loam	Sandy Clay Loam	Sandy Clay Loam	Sandy Clay Loam	Sandy Clay Loam
Lime Status	Nil	Nil	Nil	Nil	Nil	Nil	Present	Present	Nil
Heavy metals (ppm)	Present	Present	Present	Present	Present	Present	Present	Present	Present

the soil will influenced by the annual crop rotation practice, quality of water used for irrigation and application of chemical fertilizer and so on.

CONCLUSION

There is an increasing awareness of the need to assess plant micronutrient requirements and their availabilities in

soil as deficiencies of macronutrients are corrected. The quantity of a micronutrient that is available for plant uptake is invariably very much less than the total amount in soil and the availability of each micronutrient depends on the form – mineral or organic complex – in which it can be taken up by plant roots. A complicating factor of great importance is the fact that the relative proportions of the forms in which micronutrients occur in soil can change with soil pH and redox potential and the amount

Figure 4. Variations of soil micronutrients in the rhizosphere of *Casuarina*.

of soil organic matter. Thus the availability of micronutrients changes with soil conditions and this makes generalisations extremely difficult. Improvements in analytical techniques for determining micronutrients in plant tissue and available forms in soil in recent years suggest that refinements in estimating critical concentrations in plants and soils should be possible. With such information, correcting deficiencies, recognising toxicities and defining suboptimal micronutrient levels in soils and plants should ensure that no nutrient limits the attainment of optimum economic yields of crops and performance of animals. But to achieve this will also require that the best forms and ways of delivering micronutrients, i.e. by foliar application or by addition to the soil, are adequately researched.

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