IJASRM International Journal of Advanced Scientific Research and Management, Volume 3 Issue 10, Oct 2018
www.ijasrm.com
ISSN 2455-6378

Soil Analysis for Macro and Micro Nutrients from the Bamboo (Ochlandra) growing Forest areas in Thiruvananthapuram, Kerala.

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Abstract

In this study ten elements essential for the plant growth were analyzed in the soil samples of the *Ochlandra travancorica* (Bonacaud) and *Ochlandra wightii* (Kallar) from Thiruvananthapuram District, Kerala. The experimental results in the soil samples analyzed from subsurface revealed the following: K(235.2 and481.6(Kg/ha)),P(17.7 and12.75 (Kg/ha)), S (18.96 and 13.8 ppm), Ca (160 and 262.5 ppm), Mg (34.5 and 32.25ppm), Zn (0.9and 0.79 ppm), Fe (64 and 38.6 ppm), Mn (14 and 19ppm), and B(0.71 and 0.09 ppm) from the sites of *O.wightii* and *O.travancorica* respectively. Further analysis of the soil physical parameters revealed a pH of 4.8 and 5.4 and electrical conductivity of 0.08 and 0.22 respectively for *O.wightii* and *O.travancorica*. Organic carbon in the samples was 1.2% and 2.5% respectively. Soil analysis is a valuable tool in nutrient management. It enables prediction and determination of proper amounts of nutrients in a given soil based on its inherent fertility and crop needs.

Keywords: Soil, Micronutrients, Macronutrients, Ochlandra

1. Introduction

Soil, the skin of the earth, is the main important Primary component of all the terrestrial ecosystems. It consists of organic matter, minerals, water, holds gases and organisms. Any change in the natural function of the soil has a potential to alter the natural ecosystems present there. Soil sampling helps in determining the physical condition, nutrient status and the chemical properties that help in the growth of plants.

Plants need a number of nutrients to survive and it is mainly obtained from the soil below. Soil consists of both macronutrients and micronutrients. Macronutrients are further divided as Primary and Secondary nutrients. Nitrogen (N), Phosphorous (P) and Potassium (K) are the primary nutrients that plants require in large amount.

Calcium (Ca), Magnesium (Mg), and Sulphur (S) are the three secondary nutrients required in smaller amounts compared to primary nutrients. The macronutrients limit or co- limit the plant growth and alters the nutrient limitation on land (Marklein and Houlton, 2012).

The micronutrients Boron (B), Chlorine (Cl), Copper (Cu), Iron (Fe), Manganese (Mn), Molybdenum (Mo) and Zinc (Zn) are required in very small amount in the soil but they are as important as the primary nutrients. For most micronutrients, crop uptake is less and critical plant functions are limited if micronutrients are unavailable.

Ochlandra spp. is excellent soil binders in hilly zones of Kerala. The reed bamboos play an important role in increasing the fertility and conservation of soil(Sujatha et.al,2008).The main objective of the soil analysis is to assess the nutrient supplying power of Ochlandra growing soil collected from the reserve forest areas (Kallar and Bonacaud) of Thiruvananthapuram, which form the basis of nutrients in the plant body.

2. Review of Literature

Soil occupies the most important part of earth's surface that mainly supports plant and that affect climate and biological activities (Brady and Weil, 2002). Healthy soils have the ability to recover from the environmental disturbances and human exploitation (Ellert et.al, 1997). In extremely acidic or alkaline soil, many of the plant nutrients remain unavailable for plants since it is being converted and fixed during different reactions. There exist a relation between soil pH and macronutrients like Nitrogen, Phosphorous, Potassium, Calcium, Magnesium and Sulphur. (Dinesh et.al, 2016)

3. Materials and Methods

The study was conducted in reserve forest areas at Kallar and Bonacaud, Thiruvananthapuram, Kerala. Both field studies and Laboratory studies were undertaken. Different spots of sampling near to the species were located. Top soil with humus and surface litter was scraped away and soil was collected from the shallow subsurface intervals of 30 cm. Two- five samples were randomly selected and a V shaped cut to the plough depth is made. Soil samples of about 500 g were collected and were air-dried under shade. Roots and any other extraneous materials were manually removed. Soil samples were collected in the month of October 2017 and the physical and chemical properties were assessed. Analysis of the soil sample includes pH (pH meter), Organic carbon (Walkley Black wet digestion method, 1947), Electrical conductivity (Conductivity meter), Available macronutrients like Phosphorous (Bray and Kurtz, 1945), Pottasium (Ammonium acetate extraction method, Flame Photometer), Calcium and Magnesium(Ammonium acetate extraction method, Atomic Absorbtion Spectroscopy) Sulphur(Barium chloride turbidimetric method, Spectrophotometer) and available micronutrients like Iron, Manganese, Zinc and Copper(Atomic Absorbtion Spectroscopy) and Boron (Hot water extract)(Manual on soil, plant, water and organic manure analysis,2013).This data is used to analyse and compare the nutrient status of soil and plant.

4. Results

In this study ten elements essential for the plant growth were analysed from the soil samples in the Kallar and Bonacaud region of Thiruvananthapuram District, Kerala. The sample soil has been compared with a control. The analysis primarily interprets the pH, Electrical conductivity and Organic carbon of the sample and also the control. It focuses on the Primary plant nutrients like Phosphorous and Potassium; Secondary plant nutrients Calcium, Magnesium and Sulphur; Plant micronutrients like Iron, Manganese, Zinc, Copper and Boron

4.1 *Ochlandra wightii* from Kallar

The result of the soil sample collected during the survey studies at a depth of 30cm shows that the sample was brown in colour. Soil sample collected from the site of Ochlandra, the pH recorded was 4.8 when compared to the control 5.4, is a measure of hydrogen ion activity of the soil water system and indicates the soil is acidic in nature. pH is more acidic where weathering and rainfall is more advanced. Electrical conductivity in soil water system was 0.08 and in control it was 0.21, is a measure of concentration of soluble salts and extent of salinity in the soil. The values for Organic carbon in the sample are 1.2 and that of control is 1.1, which are below 2% which shows soil lack in organic carbon.

The Phosphorous level for both control site and sample site falls in a range which is deficient for the natural growth of plants. The availability of potassium in the soil near to bamboo species is 235.2, which shows a decline in fertility and a trend towards future deficiencies when compared with that of the control which falls in the low fertility level. The fertility level of Calcium and Magnesium was less (160 ppm and 34.25 ppm) compared to the control sample (180ppm and 34.5). The presence of Sulphur in the sample soil was higher (18.96 ppm) when compared with the control sample (14.04).

The sample soil was absent in Copper while the control showed 5 ppm. Hence indicating that the sample is deficient in copper where as in control, there is well enrichment of Cu in the soil. The amount of Boron was 0.30ppm in control to that of 0.71ppm in sample site. The presence of Iron in the soil sample was 64ppm whereas in control it was 100ppm which is very high as the normal range for Fe varies between 2.5 to 4.5 ppm. The sample soil was highly enriched in Manganese. The soil sample from the study area show manganese content as 14ppm when compared with the control it was 56ppm in control. The sample soil showed the normal range of Zinc and the control soil were

enriched in Zinc. It was analysed to be 0.9 ppm and 3.2 ppm respectively. The presence of Boron was comparatively higher when compared with the sample. It was 0.71 ppm and 0.30 ppm respectively. The data are represented graphically in Fig.1 and Fig.2 respectively.

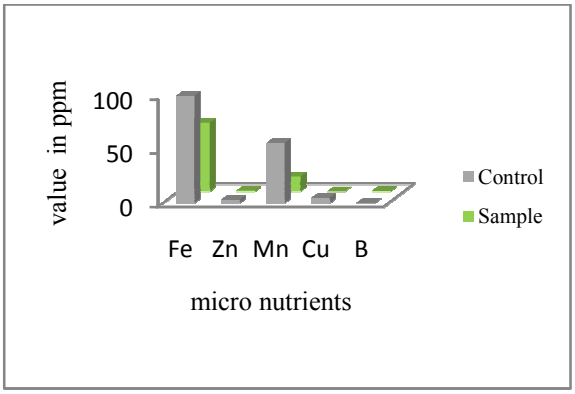

Fig.1. Comparison of micro nutrients of *O.wightii*

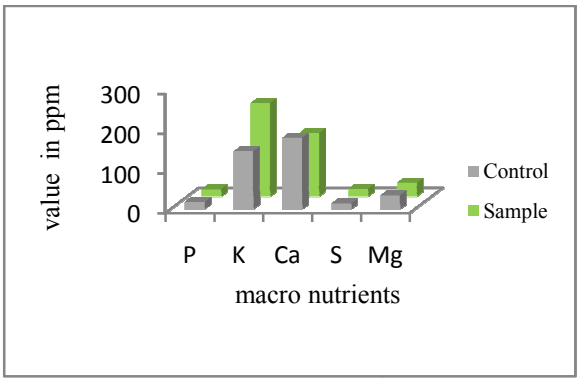

Fig.2. Comparison of macro nutrients of *O.wightii*

4.2 Ochlandra travancorica from Bonacaud

The soil samples collected from Bonacaud where *Ochlandra travancorica* is flourishing the pH recorded was 5.4 when compared to the control 5.2. The electrical conductivity noted was 0.22 and the organic content was about 2.52% slightly higher than the control site. The macro nutrient Phosphorous level both in soil sample and control is 12.75 and 24.9 (Kg/ha) respectively. The level of Potassium was much higher in sample site when compared to the control site. The result of Calcium analysis shows that there was no much difference in the soil from areas near to *Ochlandra travancorica* and the site devoid of the reed bamboos. The presence of Sulphur in the sample site was much higher when compared with the control site (13.8 and 5.09 ppm) respectively.

The micronutrients Copper and Boron were absent or negligible in both the sample site and the control site. The presence of Iron in the soil sample was 38.6ppm whereas in control it was 36.3ppm which is comparatively high. Both the sample soil and soil from control site when analysed showed that it was rich in Manganese. The presence of Zinc in the sample soil falls in the normal range needed for the plant growth. The micro and macro nutrients of *O.travancorica* are represented in Fig.3 and Fig.4 respectively.

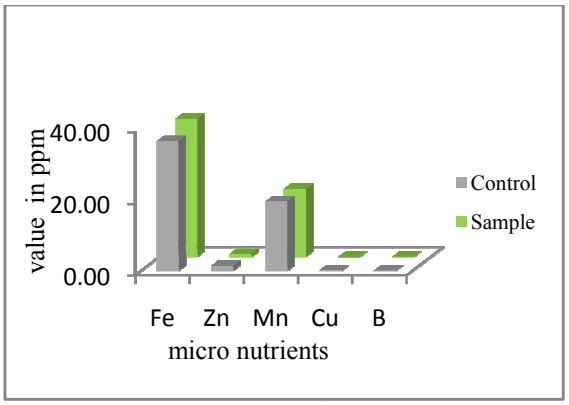

Fig.3 Comparison of micro nutrients of *O.travancorica*

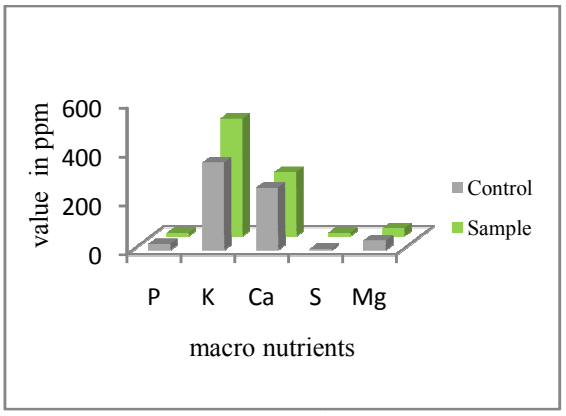

Fig.4 Comparison of macro nutrients of *O.travancorica*

5. Discussion

Among the grass family, bamboo is the heavy nutrient feeder. The nutrient content of the soil is directly related to the growth and yield of the plant. The present study has analyzed different nutrients of bamboo growing soil at Kallar and Bonacaud forest regions in Thiruvananthapuram. It is concluded that the pH of the study site was acidic and the soil was saline in nature. pH is more acidic where weathering and rainfall is more advanced. Soil pH when less than 5.5, it influences the nutrient availability and

may result in Calcium (Ca), Magnesium (Mg) and Phosphorus (P) deficiency or excess of manganese (Mn) and iron (Fe). Micronutrients are most available in acid soils and often unavailable at high pH. All physical, chemical and biological soil properties are affected by pH[4]. Electrical conductivity was found to be below 1 which is harmless. EC for non- saline soil is 0 - 1.4 mS/cm while for strongly saline it ranges between 4.5 - 11.4 mS/cm. The low values for EC may be due to high rainfall in this area which washes out soluble cations from the soils. Soil organic matter has been defined as the organic fraction of soil including plant, animal and microbial residues, fresh and at all stages of decomposition and the relatively resistant soil humus. However, soil organic matter estimate includes only those organic materials that accompany soil particles through a 2mm sieve. Carbon is the chief element present in the soil organic matter and forms 48-58% of the total weight. The soil analysed for *O.wightii* was little deficient in organic matter and in Nitrogen when compared with *O.travancorica*. Organic carbon determinations are often used as a basis for estimation of organic matter. The presence of organic carbon is supposed to be the indicator of available Nitrogen status of the soil. pH and organic carbon content are highly responsible for the degree of availability of micronutrients to plants. Calcium is essential, not only to correct soil acidity but also as a nutrient element necessary for normal plant growth. Hence, soil Ca plays an essential role in regulating soil pH.

The Phosphorous level both in soil sample and control in Kallar, is deficient in when compared with the standard of 20-40ppm. But sample soil analysis done for *O.travancorica* falls in the required range. Potassium undergoes reaction with Calcium and Magnesium and it affects the plant available potassium. Calcium, Magnesium and Sulphur are considered secondary because they are essential for crop development but the uptake is usually lower than for the primary nutrients, Phosphorous and Potassium, but considerably higher than the micronutrients. Calcium and Magnesium have similar chemical properties in soil. Soil from Kallar was deficient in calcium and magnesium but the soil analysis done for *O.travancorica* from Bonacaud shows that the amount of calcium is much higher compared to the amount of Magnesium in the soil. If Ca:Mg ratios are greater than 8:1, there is a chance for Magnesium deficiency. When the concentration of Mg is greater than twice those of Ca, an unfavorable plant growth and poor soil structure may occur. The amount of Sulphur from soil at Kallar showed much higher value than those from Bonacaud. Sulphur containing soil generally lowers the pH. Micronutrients are required in smaller amounts than macronutrients or secondary nutrients. Copper, Iron, Manganese and Zinc exist as minerals adsorbed to the soil particles. The presence of organic matter increases the availability of micronutrients to the plants but high carbon ratio may temporarily immobilize these nutrients until carbon decomposes. Zinc and Boron deficiencies may occur in acidic soils where leaching with low salt irrigation water occurs. The optimum range for Copper is 0.2 to 2.5 ppm but soil from both Kallar and Bonacaud lacked copper in them. The amount of Boron was negligible in the soil samples of Bonacaud. The presence of Iron and Manganese was much higher in both the sites and control sites which can be mainly due to the presence of Bamboos. The normal range for Fe varies between 2.5 to 4.5 ppm and that of Manganese ranges from 1.02 to 2.5 ppm. The amount of Zinc falls in the normal range in both bamboo growing sites and in both sites Zinc was more in control sites. The normal range was between0.51 to 1.21ppm.

5. Conclusions

Soil is the main important Primary component of all the terrestrial ecosystems. Any change in the natural function of the soil has a potential to alter the natural ecosystems present there. Soil sampling helps in determining the physical condition, nutrient status and the chemical properties that help in the growth of plants. Increased soil acidity reduces the nutrient availability, decreases the rate of decomposition and alters the rate of microbial function. Hence, Soil analysis provides sufficient information about the nutrient availability related to plant growth. Further studies are needed in this field to analyse the effect of bamboos on the soil nutrients.

Acknowledgments

I thankfully acknowledge The Office of the Principal Chief Conservator of Forests(Wildlife) & Chief Wildlife Warden, Kerala Forest Department for permitting me to collect soil samples from the reserve forests of Kallar and Bonacaud, Thiruvanathapuram, Kerala for my study.

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