PHYSICO – CHEMICAL ANALYSIS OF SOIL SAMPLES COLLECTED FROM TERMITARIA

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ABSTRACT

The study of the Physico - Chemical parameters like electrical conductivity, pH, total organic carbon, available nitrogen, boron, phosphorus, potassium content, available calcium, iron, copper, manganese, zinc magnesium, and moisture content, of the soil samples collected from termitaria and was compared with that of the nearby agricultural land was carried out. This study leads to the conclusion that both the termite soil mounds and the adjacent soil samples are strongly acidic, moisture content of the termite mound is higher, soil organic matter, nitrogen and phosphorus content of termite mound soil are low compared to nearby agricultural soil. Potassium content of termite mound is higher and the calcium and magnesium levels are low. In termite mound soil, available iron, manganese, zinc and copper are comparatively lower than adjacent land soil samples. This shows that the fertilizer property of termite soil is very less compared to agricultural land soil.

KEYWORDS: Termitaria, Electrical Conductivity, Moisture Content & Total Organic Carbon

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INTRODUCTION

Soil is a living, and a dynamic component of the agro ecosystem. It is a thin layer of earth crust which serves as a medium for growth of plants and some microorganisms, which comprised of water, air, minerals, and soil organic matter (SOM).

Soil composition may vary from one location to another, like agricultural soil and termite mound soil. It generally consists of organic decaying matter, inorganic materials, water and air. Sand, silt, and clay are the basic types of soil. Ants can change the physical and chemical parameters of soil. White ant mounds also known as “termitaria” formed when soil grows beyond its initially concealing surface. These are called ant hills. In this study, a comparative study of soils from four termite hills and four corresponding normal soil samples collected from the plane land about 1 meter away from the hills is made.

Figure 1: Ant hill (“Termitaria”)

Carbon, hydrogen, oxygen, nitrogen, phosphorus, sulfur, potassium, calcium, magnesium, iron, copper, zinc, manganese, molybdenum and boron are the essential elements for the proper growth of plants in soil. A literature survey was carried out to understand similar studies carried out with particular reference to the termite hill. But unfortunately, only very rare work is reported in this area which increases the importance of this work.

Thomas Bourguignon et al. studied the influence of Soil Properties on Soldier less Termite distribution. Charles D Sopher and Ralph j Mccracken(2000) studied the corn yield on south Atlantic coastal soil and the relationship between soil properties and management practice. The distribution of chemical elements like copper, lead, zinc etc. was studied both in termite soil and adjacent surface soil by Nagaraju Arveti et al.

Subha Rao (1993) reported the need for the estimation of available nutrients in soil. Sudhir K Sharma and Naveen Kalra (2006) have studied the effects of fly ash incorporation on soil properties and productivity of crops. Nicol whitney and D.Zabowski et al (2004) calculated total soil N in the coarse fraction and at depth. Skye A Mills, C Lee Burras and Jonathan A Sandor (2000) proved that the laboratory and field measurements of soil color can be used for the prediction of soil organic carbon content. Min Liu, D.E Kissel, L.S.Sonon, A.L.Cabrera and P.F Vendrell studied on the effects of biological N reactions on soil lime requirement determined by incubation. Pirkko Laitinen, Katri Simmen, Sari Ramo (2007) had studied the effects of soil phosphorous on environment. Usha Mathew and Alice Abraham (1989) made studies on paddy soils in Kerala reveal that the soil type, flooding has resulted in the rise of pH and availability of N, P and K. A. D. Karathanasis, R. A. Olson, V. A. Johnson, D. H. Sander and G. A. Peterson (1979) studied the relation of soil properties and other environmental factors on grain yield

MATERIALS AND METHODS

The area selected for the study was the place containing white ant hills in different areas in the Wayanad and Kozhikode districts of Kerala state. The major crops cultivated in the study area were coconut, areca nut, mango, banana, and vegetables. The study was conducted using soil collected from termite mount and nearby plain land soil.

Samples of white ant hills were collected from different ant hills and for each hill samples were picked. This was done for four ant hills in four different areas. Four samples of normal soils were collected about 1m away from each of the ant hills.

The soil sample was analyzed for its chemical properties like electrical conductivity, organic carbon and pH, as per method reported in standard literature. Analysis is also carried out for the available form of major nutrients like nitrogen, phosphorous, copper, boron, calcium, magnesium, manganese, zinc, and iron. Analysis of the soil for these properties provides information on nutrients available in soil.

Organic and inorganic forms of carbon are present in soil. In most soil the majority of carbon is held as soil organic carbon (SOC). The range of soil organic carbon in soil varies from 1% in sandy soil to 100% in wetland soil. Back titration with standard Mohr's salt solution is used to determine the SOC and the gravimetric method is used for Moisture content measurement. pH and electrical conductivity measured using pH meter and conductivity bridge respectively. Bray No1 method is used for finding the available phosphorous. Available calcium and magnesium was determined using ammonium acetate extract of soil. For the determination of available iron zinc manganese, copper and boron, atomic absorption spectrometer is used.

RESULTS AND DISCUSSIONS

In the present investigation, the soils were subjected to analyses for properties such as organic carbon, pH, electrical conductivity and moisture content studies. The soils were also analyzed for available major nutrients like nitrogen, phosphorus, calcium, magnesium, potassium, manganese, zinc, copper and boron.

The chemical properties of termite mounds and adjacent soil showed significant differences. pH values proved that all the soil samples are acidic in nature. Both the termite mounds and adjacent soil samples were strongly acidic, PH values of various samples ranging from 4 to 5.2. This may due to humus decomposition, which results in the release of large amounts of acids and thereby lowering the pH. In all the pictures, the first four are termite samples, and the remaining four are the corresponding plane land samples.

Figure 2

Figure 3

Comparatively the electrical conductivity of termite mound soil is lower than the adjacent soils. The electrical conductivity values of all the soil samples are below 1, and hence these soils are normal. Present data revealed that the electrical conductivity of agricultural soil sample was 0.19dS/m and for the nearest mound soil, it was 0.14dS/m.

The moisture content of termite mound soil is comparatively higher than that of the adjacent soils due to need of water content in the termite mound for their structural modification. Lower value of moisture content in the mound soil is an indication of a dry nature of termite soil compared with nearby soil.

In this study the organic carbon content in the termite mound was in between 0.7% and 1.4% and the organic carbon content in the four soil samples was in between 0.7% and 2.2%. Organic carbon content was in between 0.5% and 3.5%. The results show that the soil is medium. The lower values of the percentage carbon of termite soil compared to normal soil may be due to removal of organic carbon by termite. Results also show that sample 6 is having high moisture content and organic carbon content when compared with other samples. The results of nitrogen analysis show that the nitrogen content in termite mounds soil is comparatively lower than the corresponding adjacent soil. In the present study nitrogen content obtained was 196 ppm in surrounding soil and 114 ppm in mound soil.

Figure 4

Figure 5

MC is Moisture Content and OC is Organic Content

The level of phosphorous was found to be low in some samples of termite mound soils. The P level is in the range of 4ppm to 9ppm. The adjacent soil samples show higher P contents compared with termite mound. The results show that the termite mound soil possesses low phosphorous content.

Potassium level in termite mounds is higher than adjacent soils, which is found in the range of 95 ppm to 180 ppm. In the present study potassium was noticed as 97.5 ppm in the surrounding soil and 95.5 ppm in the termite mound

soil. It is 2.05% lesser than that of the adjacent soil. Results shows that potassium level of all these samples were in the desired limit (70-130ppm) except the sample 7 which possess only 55 ppm which is below the normal limit.

The results show that Ca^{2+} and Mg^{2+} in the termite mound soil are comparatively lower than that of the adjacent soil. The Ca^{2+} level is in between 176 ppm and 632 ppm in termite mounds and Mg^{2+} level is in between 53 ppm and 220 ppm. In the case of normal soil sample the Ca^{2+} is in between 253ppm and 910ppm. The calcium was 876 ppm in land soil and 632 ppm in mound soil. The micronutrient magnesium was recorded was 333 ppm in the surrounding soil and 219.5 ppm in the termite mound soil. From the data it was found that sample 4 require lime treatment. Magnesium level of various samples was in between 52 ppm and 333 ppm.

Figure 6

Figure 7

Figure 8

Ferrous in the termite mound soil was 32 ppm and in the surrounding soil, it was 51ppm. This shows a reduction of about 37%. Zinc in the mound soil was 0.6 ppm, where as in the surrounding soil it was 1.1 ppm. Here is also a reduction in Zn percentage. Copper in the mound soil was 1.7 ppm and in the surrounding soil it was 1.8ppm. There is only a difference of about 5.5%. Manganese in the mound soil was 30.3 ppm and in the surrounding it was 30.6 ppm. It is less than control. Manganese is essential for enzymatic reactions in plants.

The boron content is also low in case of termite mound soils. The boron contents are higher in normal adjacent soils. The boron level is in between 0.08ppm and 0.12ppm. In termite, borates act as a stomach poison. The use of borates for termite prevention and control has been previously reviewed.

Table 1

Termite Mound Sample	pH	EC	MC	OC	P	K	Ca	Mg	Fe	Mn	Zn	Cu	B	N
1	4.96	0.14	0.649	1.05	4.2	95.5	632	219.5	32	30.3	0.6	1.7	0.11	114
2	4.4	0.23	0.731	1.17	5.9	179	274.5	74.5	22	20.6	0.4	0.6	0.09	128.7
3	4.5	0.16	0.646	0.8	4.2	146	523.5	193.1	27	33	0.4	0.3	0.07	84
4	4.33	0.17	0.733	1.3	8.5	137	176	52.6	25.2	4.6	0.24	0.5	0.1	142
Soil 1	5	0.19	0.731	1.8	2	97.5	876	333	51	30.6	1.1	1.8	0.15	196
Soil 2	5.1	0.3	0.845	2.17	11.8	140	909.5	280.9	50	19	2.2	2	0.14	236.7
Soil 3	4.03	0.09	0.568	0.8	5.7	55	254	78.2	50	35	0.6	0.7	0.09	86
Soil 4	4.8	0.22	0.606	1.05	15.9	169	378.5	114.7	27.3	9.6	0.74	0.34	0.13	116

CONCLUSIONS

In this work, a comparison of the physiochemical characteristics of termite mound soil and adjacent plain soils collected from an area 1Meter away from the corresponding mounds were carried out. Four different types of termite mound soils and corresponding agricultural soil from four different areas in Kerala were collected. The results show that there is a significant difference between termite mound and adjacent soil. The concentrations of nutrients were different in both soils. The termite mound soil was significantly different from the surrounding soil in all chemical parameters. Termite mound soil is having greater concentration of K and lower Ph, organic carbon, total N, and lower concentration of Ca^{2+} , Mg^{2+} , P, Cu and B. In contrast, the soil from surrounding agricultural soil is having more C, N, P, Ca^{2+} , Mg^{2+} , and B. This shows that there is significant difference in nutrient concentration between the termite mound and the adjacent soil. The test parameters such as organic carbon, phosphorus, K, Mg, and Ca were declining. This study highlights that the termite

mound soil nutrient level is generally less than the surrounding agricultural soil. This study came to the conclusion that the termite soil possesses less fertilizer property.

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