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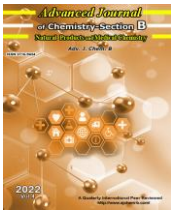

Original Research Article

Assessment of Physiochemical Properties in Soil from Selected Farmlands in Nasarawa West, Nasarawa State, Nigeria

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ABSTRACT

The farmlands that were chosen in this work were four (4), which includes Nagari Farm (Gauta Keffi local government), Sharna farm (Abuja Road Karu local government), Gyunkas integrated farm (Kokona local government) and Gunduma farm (Kaduna road, Karu local government respectively. This research aimed at accessing some selected physiochemical properties of soil samples which includes pH of the soil, electric conduction (EC), totality of organic carbonate (TOC) and totality of organic nitrogens (TON). The physical and chemical characteristics of the samples of soil were examined using approved standards method for each of them. The result obtained in this study, showed that there is moderate acid in the soil and also, there are some matters that are organic in nature and ionisable materials. Overall results of both pH, EC, TOC and TON analysis of the soil samples investigated were within the standard limits of WHO and FAO.

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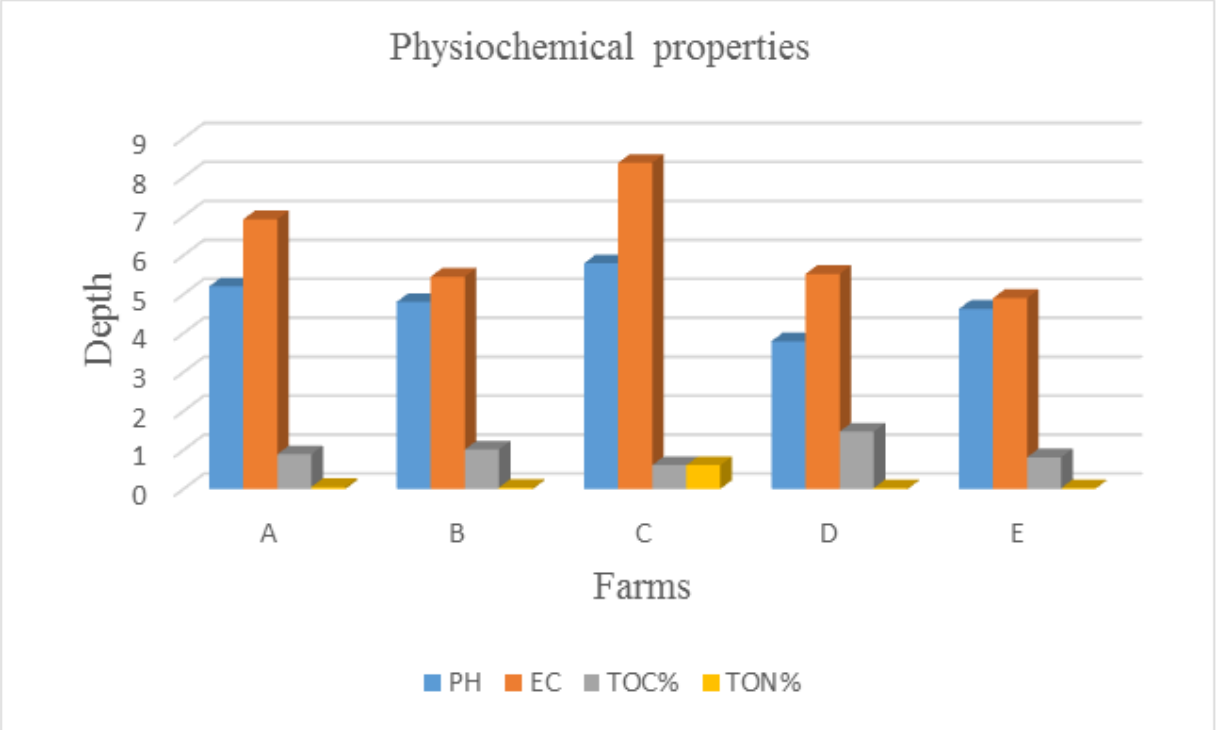
GRAPHICAL ABSTRACT



1. INTRODUCTION

Soil is an environmental system component used by man and other living organisms like plant animals, and microorganisms in terms of links between its properties, processes and other environmental components such as water, air, mineral elements and other abiotic components. The defined soil physical properties as the arrangement or grouping of individual soil particles into units forming a porous medium. Examples include texture of soil, content of matter that are organic in nature, EC, pH and moist contents [1].

pH of soil is understood to be among the principal factors that tells the metals concentration in the solution of soil, how they are available to plants as well as how they are mobile [1]. One of those things which hindered the mobilization of the heavy metal's intensity is increase in the concentration of hydrogen ion [2]. For instance, mobility of Cadmium occored below pH value 6.5, while Pb becomes more active at pH value 4.00. All soils contain organic matter, however with considerably differences in amount and type [3]. Organic matter of soil is considered as soil fraction which composed of tissues of plant or animal in several breakdown level (i.e., decomposition) [4]. Material range of matters that are organic in soil are from the real plants and animals' tissues to the mixture of materials that decomposed substantially which are called humus [5]. Organic matter particles have a net negative charge [6]. Soil organic matter has a superior influence on the soil chemical characteristics, and generally contain higher exchange capacity of cat ion. Exchange capacity of cat ion is a factor that measures the ability of soil to retain positive charged ions, giving a stronger metal cat ions adsorption [7]. Therefore, organic soils contaminated with heavy metals are more immobile and least bioavailable than metals in mineral soils [8].

2. MATERIALS AND METHODS

2.1. Soil pH

The physicochemical properties of soil were examined using standards method that is approved each. *p*H of soil was measure as a proportion of 1:2:5 [9]. A 5g portion of air-dried sediments were weight using analytical balance and 25 cm^3 of water (distilled) introduced and affiliated for 5 minutes and left the solution without disturbance for 1 hour. pH meter was utilized to take the record of the acidity or basicity by immersing the electrode in each of the solution of the sample. All readings were recorded.

2.2. Soil Salinity (Electrical Conductivity Procedure)

20g of soil was weighed into a 125cm^3 beaker. 20cm^3 of distilled water was added to the breaker and stirred with glass until well mix for about 30 minutes.

The EC of the soil suspension were measure at 25^oC with conductivity meter. The conductivity meter probe was properly rinsed with distilled water before and after reading.

2.3. Total Organic Carbon (TOC)

Five grams (5 g) of the sample of soil were subjected for 30 minutes to heated at 20^oC. The samples of the soil were later shake in water (distilled). The samples of the soil were pre-treated in acid (hydrochloric) in order to evaporate the carbon that are inorganic and pass the test over a catalyser to send out the acid that are carbonic with a non-carbon-dioxide and later quantify the solution. Shimadzu TOC-VCPH with a THM-1 Model and a sample changer, ASI-V was utilized for the test [10].

2.4. Total Organic Nitrogen (TON)

In examination for nitrogen through kjeldahls techniques 0.62g of compound that are organic was heated with acid (sulfuric). The nitrogen in compound that are organic was converted into sulphate (ammonium). The sulphate of ammonium formed was in turns subjected to heated with extras sodium hydroxide NaOH with ammonia liberation NH_3, the result (ammonia) was absorbed in sulfuric acid solution that is standard.

The produced ammonia was estimated by quantity of acid (sulphuric) used for the reaction by estimation of the amount of acid (sulfuric) left after the absorbing ammonia via titration with solution of alkali that is standard.

The gap that exist between the initial quantity of acid (sulphuric) recorded and the amount that left after the reaction provides the amount of acid reacted with ammonia reaction.

$$N_2 + H_2S0_4 \longrightarrow (NH_4)_2SO_4 \quad (1)$$

$$(NH_4)_2SO_4 + NaOH \longrightarrow 2NH_3 + NaSO_4 + 2H_2O \quad (2)$$

$$\% \text{ of } N = 1.4 \text{ m x } 2 (V\text{-}V1)/ \text{ Mass of organic compound} \quad (3)$$

Where V = volume of H_2SO_4, V1 = Volume of NaOH, M = Molarity of H_2SO_4

3. RESULTS AND DISCUSSIONS

Based on Table 1, Nike farm was recorded to have the superior value of pH of 5.79 with Gunduma farm having the least of 3.79 with arithmetic mean of 4.84 ± 0.66 and Percentage of CV as 13.6. pH value for control sample is 4.90. The results obtained in this study shows that the soil was moderately acidic. pH value recorded for the present work are in line with that reported by Osakwe, (2013) [10], but below the values reported by Matthews-Amune and Kakulu, (2013) [11]. At superior values of pH, phosphates of metal mineral and carbonates in metals formed and are not soluble whereas at inferior pH, they happen to be provided as free ionic species or a dissolved organo-metals and are bio-available [12].

Table 1. Physiochemical Parameters

	Sample code	Depth	pH	EC	TOC%	TON%
1	A	0-15	5.20	6.92	0.89	0.05
2	B	0-15	4.80	5.45	0.01	0.03
3	N	0-15	5.79	8.37	0.61	0.61
4	D	0-15	3.79	5.52	1.47	0.02
5	E	0-15	4.62	4.90	0.81	0.02
	Mean±SD	18.36±5.679	2.296±0.604	0.140±0.068	0.067±0.013	94.90±17.19
	CV%	30.93%	26.30%	48.57%	19.40%	18.11%

A = Nagari Farm; B = Sharna Farm; C = Gyunka's Integrated Farm; D = Gunduma Farm; E = Nasarawa state university football field (control site)

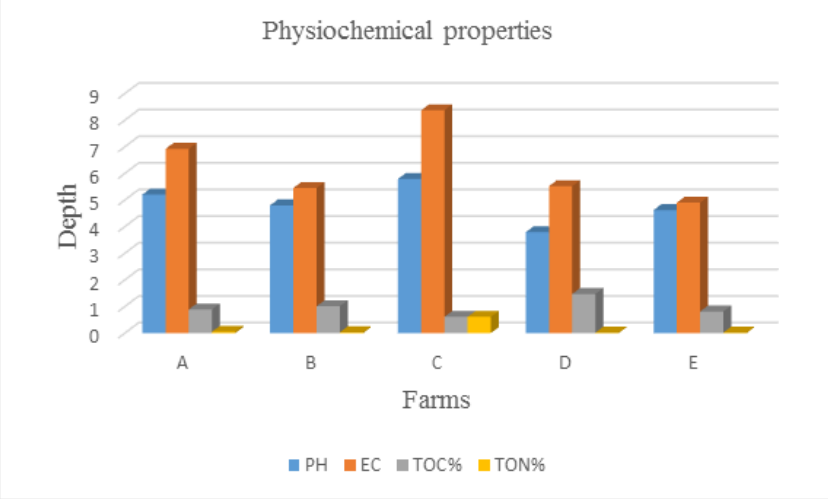


Fig 1: Physiochemical properties

A number of activities carried out by human harmfully affects the pH of close by sources of water. For example, if oxides of sulphur and that of nitrogen are produced, via operations by industries and vehicles, it may result to acid rain, and this makes water bodies acidic. Also, Pollution by chemicals, from industries and agricultural activities may pose acidity in soil and water bodies. Total nitrogen values differ from 0.02% to 0.61% with arithmetic mean of 0.15±0.23 and CV% of 153.3%. The value for the control sample is 0.02%. Through natural process like excess use of fertilizers, pesticides and lightening, decay of plant tissues, nitrogen may be induced into the soils. The total organic carbon in samples of soil from the entire locations varied as 0.61 % - 1.47 % with arithmetic mean of 0.95±028 and CV% 29.47. The value for control sample is 0.81%. The result recorded in the present work is lower compare those pointed out by Chaudheri, (2013) [13] and Tukura et al. (2007) [14] whereas superior compare to that of Idugbose et al. (2014) [15].

Total organic is a quantity of content of organic in soil and impact significantly to the soil acidity via organic acid and activities of biology via the metal's appearance.

Based on Figure 1, Electric conduction (EC) of the samples of soil from entire locations ranged varies from (µs/cm) 5.45 -8.37 with a mean value 6.23±1.25 and CV% 20.1. The value for control sample is 4.90 (μscm^{1-}). The results recorded in the present work is lower compare

to that recorded by Badejo et al. (2013) [16] and Obasi et al. (2013) [17]. The values obtained in this study depicted significant presence of metal ions trace or materials that are ionisable in soil [18].

4. CONCLUSION

The study has presented data on physicochemical features of samples of soil from selected farmlands across Nasarawa West senatorial district, Nasarawa State, Nigeria. The outcome of the physiochemical check of the samples of soil showed moderately acidic pH in the soil which composes of some substances that are organic and also substances that are ionisable and inorganic. More so, practices of farming affect the surrounding environment, which makes it vital to test some of the varying impacts that faming may pose on the environment like as change of land use and pollution by chemical.

The overall results for both heavy metals concentration and physio-chemical analysis of the samples of soil investigated were within the standard limits.

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