EFFECT OF INCUBATION OF BIOCHARS ON THE AMENDMENT OF CHEMICAL PROPERTIES OF ACIDIC SOIL.

Abstract

Biochar is considered as universal conditioner to improve soil quality, but its effect on different soil types and rates on soil properties,bacterial community and plant growth are still unclear,particularly in the typical acid soil in southeastern Nigeria. This study was done to know the changes in soil chemical composition which could be caused by dissolution and release of nutrients from biochar in an incubation experiment. The study was conducted during rainy season in 2022 in Sobioma Agro Farms LTD using loamy sand with acidic pH (5.7). The soil were collected from the same farm.Soil was filled in separate plastic bucket with lid (2kg capacity) and treatments imposed as per the treatment details; T1: Corn Cob charred for 60 minutes @ 20 t ha^{-1}T2: Rice husk charred for 60 minutes @ 20 t ha^{-1} and T3: Poultry manure charred for 60 minutes @ 20 t ha^{-1}. The treatments were replicated thrice, then repeated for different days of incubation (15,30 and 45days respectively). The experiment was laid out in a completely randomized design (CRD). The results revealed that, application of different biochar increased the pH and other soil chemical properties evaluated with slight increase only in exchangeable k and Na and a decrease in exchange acidity (A l and H) of soil. During the incubation experiment changes were noticed ,some nutrient element showed a continuous increase with incubation time (exchangeable Al and H in Corn cob and poultry manure biochar respectively) while some reached its maximum at the mid incubation time (CEC, BS, TN, Av.P and OM in poultry manure biochar). In some cases a decline was observed up to the mid incubation period after which an increase was observed (Exchangeable Ca and Mg in corn cob biorchar and Exchangeable k and Na in Rice husk buiochar). This work stresses the importance of biochar to soil quality improvement.

Keywords: *incubation ,biochars ,soil ,acidic soil, soil properties ,rice husk , poultry and pig manure ,fertilizer etc.*

1. INTRODUCTION

A fertilizer is any material of natural or synthetic origin that is applied to soil or to plant tissues to supply plant nutrients. Fertilizers may be distinct from liming materials or other non-nutrient soil amendments. Many sources of fertilizer exist, both natural and

industrially produced (Scherer et al, 2009). Fertilizers are used by the farmers daily to increase the crop yield. The fertilizers contain the essential nutrients required by the plants, including nitrogen, potassium, and phosphorus, Some fertilizers also contain certain "micronutrients" such as zinc and other metals, that are necessary for plant growth. Just as humans need essential minerals and nutrients for strong, healthy growth, so do the crops. The role of fertilizers in food production and nutrient provision for crops is usually underestimated. Fertilizers are food for plants, When crops are harvested, important nutrients are removed from the soil, because they follow the crop and end up at the dinner table. If the soil is not replenished with nutrients through fertilizing, crop yields will deteriorate over time, Without fertilizers, nature struggles to replenish the nutrients in the soil. The three most common mineral fertilizers are those based on nitrogen, phosphorus and potassium. Often, the plants have few possibilities to
avoid nutrient deficiencies without the help of fertilizers, Take nitrogen for example, Since plants are not capable of absorbing it from the air directly, the soil is their only means of acquiring this important nutrient. If the soil is low on nitrogen, fertilizers are needed to boost nutritional levels. Large concentrations of potassium sources occur deep below the soil surface (often around one kilometer) and are far beyond the reach of plant roots, mining of potassium brings this naturally occurring nutrient to the soil surface and within the grasp of plant roots. Phosphorus exists in certain rocks, but for plants to access this nutrient, it needs to be water soluble. The correct use of phosphorus fertilizers helps plants absorb it through the soil and ensures a high production and rapid growth. There are two types of fertilizer, which are, organic and inorganic fertilizer. Organic and inorganic fertilizers deliver these nutrients in different ways. Organic fertilizers are natural, in that the nutrients they possess are strictly comprised of plant or animal based materials. Inorganic fertilizer is synthetic, comprised of minerals and synthetic chemicals. Most of the minerals in inorganic fertilizer are mined from the earth, and balanced inorganic fertilizers are high in all three macronutrients and can contain ammonium sulfate,magnesium sulfate, and potassium chloride. Inorganic fertilizers are widely used to meet the demand rising from increasing population, despite its benefits in agriculture it has huge negative side effects as Inorganic fertilizers tend to lower soil pH, making it more acidic which is unfavorable for plant growth. In addition to altering soil pH levels, inorganic fertilizers do not contribute to enhancing soil structure, the use of inorganic fertilizer also has direct impacts on the local environment where it is used. Only approximately half of the inorganic nitrogen fertilizer is utilized by plants in the area where it is applied. Some of the other 50 percent is released into the atmosphere after microorganisms in the soil convert it to nitrous oxide, a gas that contributes to global warming. Inorganic (Maureen Malone 2021). Organic fertilizers has proven so difficult for farmers to get due to its expensive cost and it's harmful effects to the environment, but Biochar can be introduced to cub these effects as it has proven more suitable for plant growth and environment friendliness. Organic fertilizers despite boasting of it's role in soil fertility improvement cannot meet with the requirement for the increasing population. Hence, there's need for a possible alternative. Biochar can be an alternative to these problems as it serves as a soil ameliorant for both carbon sequestration and soil health benefits.Biochar is a charcoal-like substance that's made by burning organic material from agricultural and forestry wastes (also called biomass) in a controlled process called pyrolysis (Stefanie Spears 2018).

Apart from ,serving as a soil ameliorant for both carbon sequestration and soil health benefits, farmers can also produce biochar from the comfort of their homes without bothering about costs and difficulty in production. Biochar may increase the soil fertility of acidic soil, increase

agricultural productivity and provide protection against soil borne diseases and some foliar (slash and Char, 2014). Biochar has also been shown to reduce the leaching of bacteria through sandy soils depending on application rate, feedstock, pyrolysis temperature. Biochar also improves the soil moisture content, soil texture and surface properties of the bacteria (Bolster Ch, Abit S.M 2012). Biomass burning and natural decomposition releases large amounts of carbon dioxide and methane to the Earth's atmosphere. The biochar production process also releases CO2 (up to 50% of the biomass), however, the remaining carbon content becomes indefinitely stable (Woolf, et al., 2010). Biochar can sequester carbon in the soil for hundreds to thousands of years, like coal (Lehmann 2007b), this technique is advocated by scientists including James Hansen (Hamilton, Tyler 2009) and James Lovelock (Vince 2009). Biochar carbon remains in the ground for centuries, slowing the growth in atmospheric. greenhouse gas levels. Simultaneously, its presence in the earth can improve water quality, increase soil fertility, raise agricultural productivity, and reduce pressure on old-growth forests (Laird 2008). For plants that require high potash and elevated pH, biochar can improve yield (Tenic et al, 2020). Biochar can improve water quality, reduce soil emissions of greenhouse gases, reduce nutrient leaching, reduce soil acidity, and reduce irrigation and fertilizer requirements (Day et al, 2005).
Biochar reduces the need for nitrogen fertilizers, thereby reducing cost and emissions from fertilizer production and transport (Gaunt and Lehmann 2008). At 10% levels biochar reduced contaminant levels in plants by up to 80%, while reducing chlordane and DDX content in the plants by 68 and 79%, respectively (Elmer, et al., 2009). However, because of its high adsorption capacity, biochar may reduce pesticide efficacy (Graber E. R. etal, 2011).

The objective of the study is to observe the changes in some selected soil properties after amendment with plant-based biochar (Rice husk biochar and corn cob biochar) in a laboratory incubation condition.

2. EXPERIMENTAL

2. 1. MATERIALS AND METHODS

This study was a pot experiment conducted in Sobioma Agro Farms , owerri , Imo state is in the South eastern rainforest zone of Nigeria and lies between latitude 56 and longitude 6^{o}7-8E. The area experiences bimodal pattern of rainfall, (April-July) and (September – November) with short spell in August normally called "August break". The mean annual maximum rainfall is 2238mm and maximum of 63-80%. The major soil class is ultisols.
The soil for incubation was gotten from a cassava farm in Sobioma Agro Farms in Ulakwo , Owerri North, Imo State.
Biochar used in this work was obtained from two agricultural waste residue (rice husk and corn cob)and poultry manure. All the materials was air dried and grinded. Then a 500g of each samples was inserted into biochar machine designed by me. Prior to the insertion of the materials that was charred, the machine was heated for 10 minutes . Each of the materials was pyrolyzed at (1hr) respectively . Prior to application in the soil, the produced biochar was analyzed for its chemical composition . The chemical composition that was determined includes ; pH , EC, Ash

content, available P, available Si, total nitrogen , total calcium, total magnesium, total potassium and total sodium.
A bulk soil samples from a depth of 0-15cm was calculated from Sobioma Agro Farms. The soil was air-dried for 3 days, crushed and sieved with 2mm sieve to remove the plant roots, debris and stones. The poultry manure and pig dung was collected from battery cage poultry and pig farm respectively. The manure was dried for 3 days, crushed, sieved and charred. 2kg air dried soil was weighed into a plastic container. The charred animal manure was thoroughly mixed with the soil at 10t/ha. The soil samples were incubated at room temperature (30^{O}C). The moisture of the soil was kept at field capacity with distilled water prior to incubation. Soil samples was collected periodically at 15,30 and 45days of incubation. Soil samples was collected by destructive method . A total of 48 plastic containers was used during the whole incubation period (4×4×3). The plastic container was arranged in completely randomized way.

TABLE 1: TREATMENT DESCRIPTION
The arrangement of the total treatment will be described in the table below.

Treatment code	Description
T1	Control
T2	Charred corn cob at 20t/ha
T3	Charred rice husk at 20t/ha
T4	Charred poultry manure 20t/ha

At each sample date, soil samples was collected through destructive sampling techniques where the whole soil mass was taken, homogenized and small portion taken. After collection, the soil samples was air-dried and sieved by passing through a 2mm sieve. These samples was analyzed for some selected soil properties . Particles size was determined using hydrometer method.

Soil data was subjected to analysis of variance (ANOVA) and Duncan New multiple range test at 5% probability level was used to compare the mean.

3. RESULTS AND DISCUSSION

The initial status of soil physico- chemical properties were shown in table 1. The value of soil texture were found to be sand (812.0gkg-'), silt (64-Ogkg-^{1}) and clay (124.0gkg-') due to this result indicated the soil texture categorized under loamy sand. In this finding, the value of the initial soil pH was categorized under slightly acidic (pH 5.7). Similarly from the table 2 the value of Exchangeable acidity and acid cations (AL^{+3}and H^{+}), total nitrogen, available phosphors and CEC were categorized under low. The other properties of soil status of exchangeable bases and organic carbon ranges from medium to high as shown in table 2.

TABLE 2 Soil status of exchangeable bases and organic carbon

S/N	**SOIL PARAMETER S**	**VALUE**

1	**S**and (gkg^{-1})	812.0
2	Silt (gkg-^{1})	64.0
3	Clay (gkg^{-1})	124.0
4	**Textural class**	**Loamy sand**
5	SoilpH	5.7
6	Available Phosphorus ($mgkg^{-1}$)	3.10
7	Total nitrogen (gkg^{-1})	0.7
8	Organic matter(gkg^{-1})	19.9
	Exchangeable cations	
9	Calcium ($cmolkg^{-1}$)	2.20
10	Magnesium ($cmolkg^{-1}$)	1.60
11	Potassium (cmolkg-^{1})	0.24
12	Sodium (cmolkg-^{1})	0.16
13	Cation exchange capacity (CEC) ($cmolkg^{-1}$)	5.10
	Exchangeable acidity	
14	Hydrogen ion ($cmolkg^{-1}$)	0.70
15	Aluminium ion ($cmolkg^{-1}$)	0.30
16	Base Saturation (%)	82.3

Table 3: The chemical properties of the biochar used for the incubation experiment

Biochar	PH (H_2 0)	Total P	Total N	O.C	Total Ca	Total Mg	Total k	Total Na

Corn cob	9.7	12.0	5.2	102.7	7.2	4.2	8.0	2.4
Rice husk	5.9	15.2	8.9	181.4	6.9	4.1	9.1	2.1
Poultry manure	9.2	21.0	8.6	95,9	8.9	5.6	12.0	2.8

The chemical composition of the biochars used in the experiment:

The biochar used in this experiment showed high pH in corn cob and poultry manure produced biochar except the rice husk biochar with pH 5.9. Higher total phosphorus were found on the animal based biochar (PMB) compare to biochar from plant source (Corn cob and rice husk biochar). In this study, the biochar carbon content and Total N ranges from 95.9 to 181.4 gkg"^{1} and 5.2 to 8.9 gkg'^{1} respectively with the highest values on rice husk biochar (Table 3). The total bases were highest in poultry manure biochar which is of animal source. This is an indication that the relevant chemical components were concentrated more in animal based biochar comparative to the plant sourced as as heat passed through them (Yuan et al. 2011).

Biochar application may improve the soil fertility status of coarse textured soils, especially soil OC, CEC, available P, exchangeable K, Ca, Mg (Chan et al., 2007; Sukartono et al., 2011) as biochar contains available nutrients (Sohi et al., 2009). Biochar application resulted in significant change of soil pH with PMD (6.07) given higher significant change which could be attributed to pH of the biochar used, the significant change found in Total N and OM is a reflection of what the biochar contained (Table 3 and 4). The increase in exchangeable cations in biochar-amended soil is a sign that biochar improved soil fertility especially for calcium and magnesium. The results obtained after the incubation experiment illustrate that biochar significantly increased CEC and available P (P < 0.05). Rice husk biochar-amended soils have significantly higher CEC than the other biochar amended soils. This might be due to the presence of cation exchange sites on the surface of biochar and its large surface area (Adekiya et al., 2020). Poultry manure showed highest significant (P O.05) effect in Cu (1.61 mgkg-^{1}), Mn (5.26 mgkg-^{1}) and Fe (6.54 mgkg'^{1}) compared to rice husk biochar and corn cob biochar (Table 4). Corn cob amended soil was highest in Zn (4.37 mgkg'^{1}) The higher values found in the biochar-amended soils might be due to the crystalline and non-crystalline minerals on the biochar surface and inside the biochar structure. These minerals dissolve and release nutrients to soil solution.

Changes in pH, Organic matter (OM), Total N, Exchangeable acidity (Al and H), Available P, Cation exchange capacity (CEC) and Base saturation (BS):

Changes in soil pH during incubation are shown in figure la. The data revealed insignificant differences among the biochar treatments of the soils used with respect to incubation time. pH of soil amended with corn cob biochar (CCB) showed a decreasing trend from the 15 days (6.16) of incubation down to 45 days (6.03). The rice husk biochar (RHB) (and the poultry manure biochar (PMB) showed a slight increase as the incubation days progresses (figure la). The. increment was as a result of organic acid upon decomposition which pushes the pH more into the acid side. In addition absorption of H+ by their soeific negative surface areas when organic amendments are added. This was similar to the work done by Hossain and Sarker (2015), who observed a decrease in pH of salt affected soils due to the addition of rice straw applied as organic amendments.

Organic matter was significant ($P < 0.05$) in both biochar used and in the incubation time (Figure 1b) The RHB and showed an increasing trend with the days of incubation. The PMD reached its peak at 30 days after incubation, hence a decreasing trend was observed, and CCB was decreasing and after 30 days of incubation an increase was observed (Figure Ib). The highest amount of soil organic carbon at the beginning of the incubation was indicative of a larger pool of the less resistant fractions that were available to be broken down and recycled, thus resulting in lower contents remaining at the end incubation. Similar results was observes by Follett et al. 2007. From several studies it has been found that the addition of organic residues increases the soil organic carbon level initially and with the course of time organic carbon content decreases in soil up to a certain period (Gulser et al, 2010 and Manivannan et al, 2009). Total nitrogen followed the same trend as in organic matter (Figure 2a). The result obtained in this study was in line with Duffera et al, 1999. In their research, they observed an increased in the concentrations of nitrogen during the first second weeks and by the second to fourth week after application, nitrogen concentrations dropped. The release of nutrients from organic manure/material and organic fertilizers depends on the types of manure, rates of application and moisture level. Rahman et al. 2013 stated that the mineralization of nitrogen is influenced by incubation period, rate of organic materials application, moisture regime and type of soil.

Exchangeable acidity (Al and H) were presented in Figures Ic and d. Exchangeable Al and H showed significant effect among the three biochar used in incubation experiment. CCB and PMB showed a continuous increase throughout the the incubation period in exchangeable Al and H respectively. A decreasing trend was observed in exchangeable Al and H from 15 DAI to 30 DAI with soils amended with (PMB and RHB) and (RHB and CCB) respectively.

Application of the three different types of biochar showed a significant increase in available P (Figure 2b). A continuous increase was observed in soil amended with RHB while PMB started with an increase from 15DAI down to 30 DAI but declines in available P after 30 DAI. CCB showed a decreasing trend in the first two week after an increasing trend was obtained. The observed increase in available P with an increase in the duration of incubation could be due to microbially mediated mineralization of soil organic P to form inorganic P (Opala et al., 2012).

The addition of biochar significantly affected ($P < 0.05$) CEC and base saturation of the acidic soil (Figures 2c and d). The Cations Exchange Capacity (CEC) and base saturation (BS) increased after amendment of the acidic soil with PMB (5.51 cmolkg^{-1} and 85.4% respectively). The application of CCB and RHB showed a declining trend from the first two week after which an increased value of CEC and BS were obtained. The observed increase in CEC due to the application of biochar could have resulted from the inherent characteristics of biochar feedstock. Biochar has high surface and, is highly porous, possesses organic materials of variable charge that have the potential to increase soil CEC and base saturation when added to soil (Glaser et al., 2002).

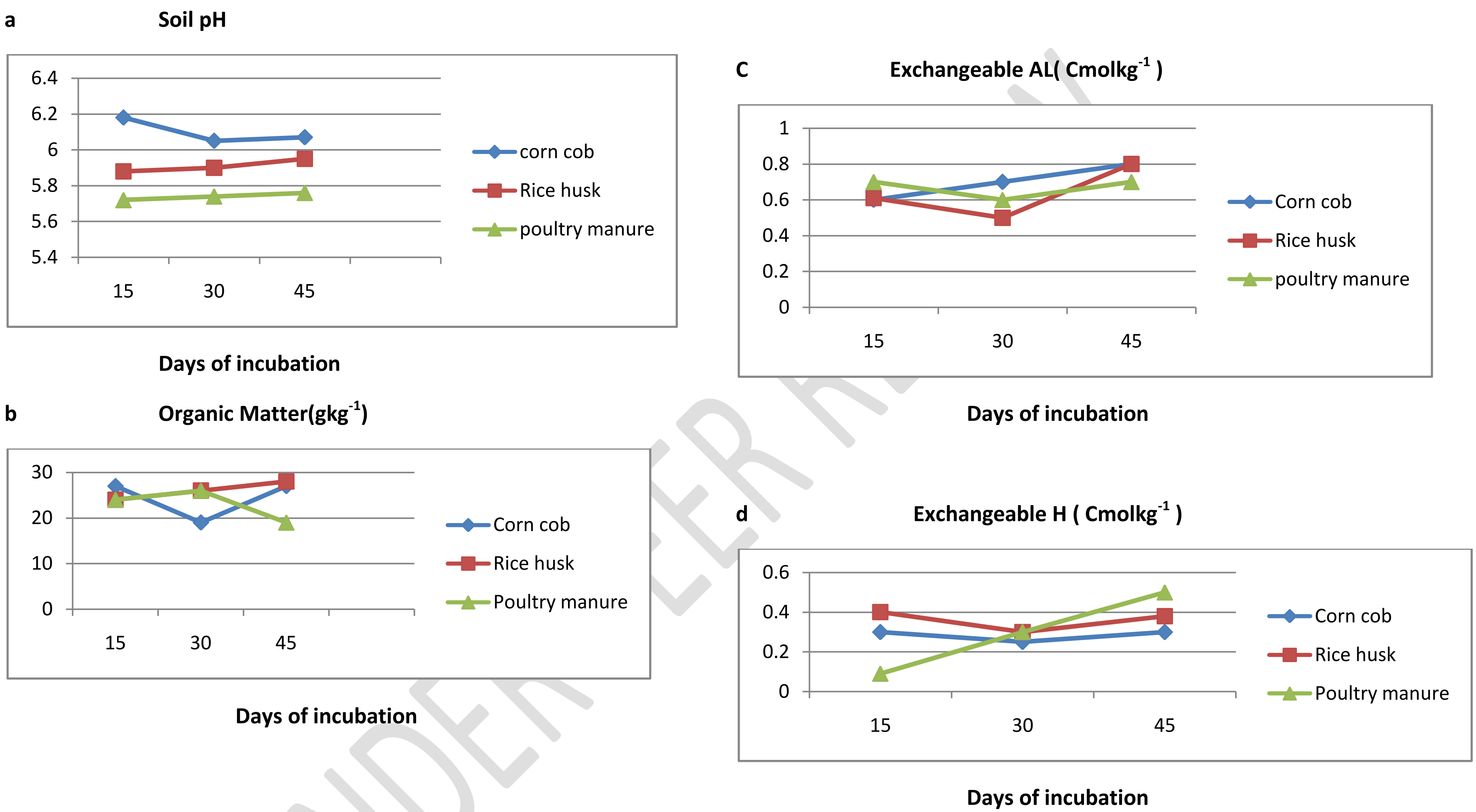

Figure 1; Effect of biochar at different incubation time on soil pH,organic matter and exchangeable acidity (AL and H).

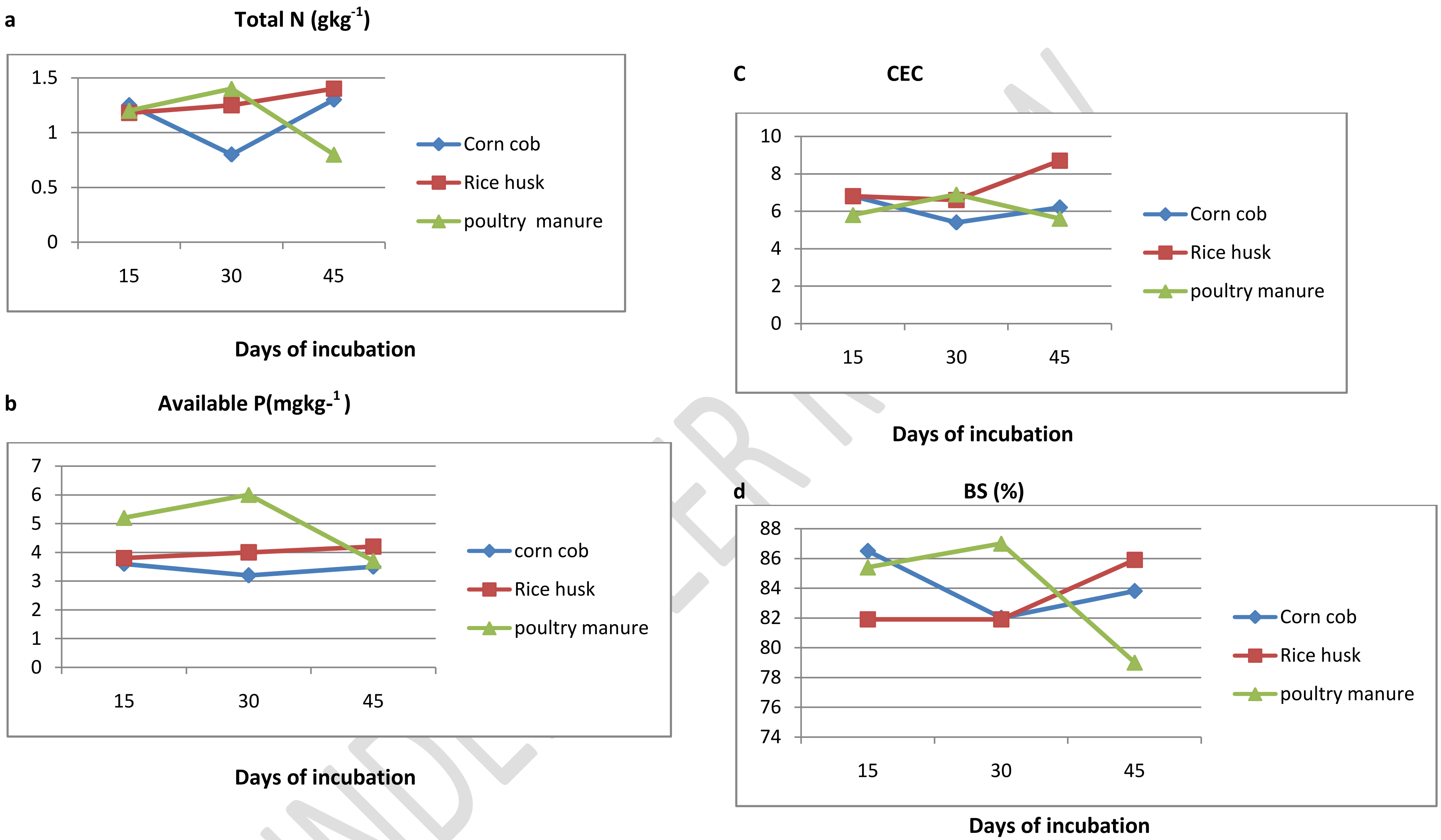

Figure 2; Effect of biochar at different incubation time on Total N, Available P, CEC and Base saturation

Changes in Exchangeable bases :

Figure 3a and b showed the changes in exchangeable calcium and magnesium throughout the incubation period with different biochar amendments. The results indicated that the concentration of calcium significantly ($P < 0.05$) increased in PMB from 2.8 cmolkg-1 at 15 days after incubation (DAI) to 3.0 cmolkg-1 at 30 DAI, afterward a decrease was observed. In soil amended with CCB a decrease was first observed followed by a increase after 30 DAI. RHB maintained the same value of Ex.Ca until after 30 DAI which subsequently showed an increasing trend. On the other hand, the magnesium content on RHB showed a continuous increasing trend in the incubation period. Soil amended with PMB showed an increasing trend from 15 DAI to 30 DAI, which subsequently showed an decrease from 30 DAI to 45 DAI. A decrease Ex Mg was obtained with the application of CCB from 15 DAI to 30 DAI abd an increase from after 30 DAI upto the end of the incubation period. This may be due to the dissolution of calcite and magnesium containing minerals in soil which results from the low soil pH. This calcium and magnesium ions displace the sodium ions from its exchange sites. A similar finding was observed by Prapagar et al. (2012).

Application of biochar showed significant ($P < 0.05$) differences in exchangeable K content in soil (Figure 3c). The exchangeable K content showed gradual decreasing trend with time of incubation from 15 DAI to 30 DAI in PMB and RHB application. Subsequently a slight increase were observed after 30 DAI. Soil amended with CCB showed a continuous increase through at the incubation period. Application of biochars prior to incubation showed significant ($P < 0.05$) differences in exchangeable Na content in the incubated soil. CCB amended soil showed a continuous gradual increase throughout the incubation period (Figure 3d). The exchangeable Na of both RHB and PMB showed the same trend in the Ex. Na content gradual decreasing trend was noticed with time of incubation in both soil amended in PMB and RHB which after 30 DAI showed a slight increase.

Increase in exchangeable bases in soil at different incubation intervals can be attributed to release of basic cations from biochar. During pyrolysis, biomass acids are converted into bio-oil and alkalinity is inherited by solid biochar (Laird et al., 2010). Most of the Ca, Mg, K, Na, and plant micronutrients in feedstock are partitioned into the biochar ash fraction during pyrolysis. Ash in biochar rapidly releases free bases such as Ca, Mg and K to the soil solution.

TABLE 4: THE SOIL CHEMICAL CHARACTERISTICS ON THE BIOCHAR AMENDED POTS.

S/N	Biorchar Treatment	Poultry Manure	Corn Cob	Rice Husk
1	Soil pH	5.73c	6.07a	5.89b
2	AP($mgkg^{-1}$)	5.11a	3.79c	4.19b
3	TN (gkg$^{-1)}$	1.10b	1.10b	1.24a
4	OM (gkg$^{-1)}$	23.2b	23.4b	26.0a
5	Ca ($cmolkg^{-1}$)	2.80c	3.00b	3.53a
6	Mg ($cmolkg^{-1}$)	1.87b	1.73c	2.18a
7	K ($cmolkg^{-1}$)	0.28a	0.21c	0.24b
8	Na ($cmolkg^{-1}$)	0.16b	0.18a	0.18a
9	H^+ ($cmolkg^{-1}$)	0.30b	0.28c	0.37a
10	Al^{3+} ($cmolkg^{-1}$)	0.67b	0.72	0.65a
11	CEC($cmolkg^{-1}$)	6.07c	6.10b	7.22a
12	BS %	83.9a	83.7b	83.1c

TABLE 5: THE SOIL MICRONUTRIENTS CHARACTERISTICS OF THE BIOCHAR AMENDED POTS

Biochar Treatment	Cu	Mn	Fe $mgkg^{-1}$	Zn
Poultry Manure	1.61a	5.26a	6.54a	3.91
Corn Cob	1.34b	4.28b	5.10c	4.73a
Rice husk	1.03c	4.25c	5.54b	3.73c

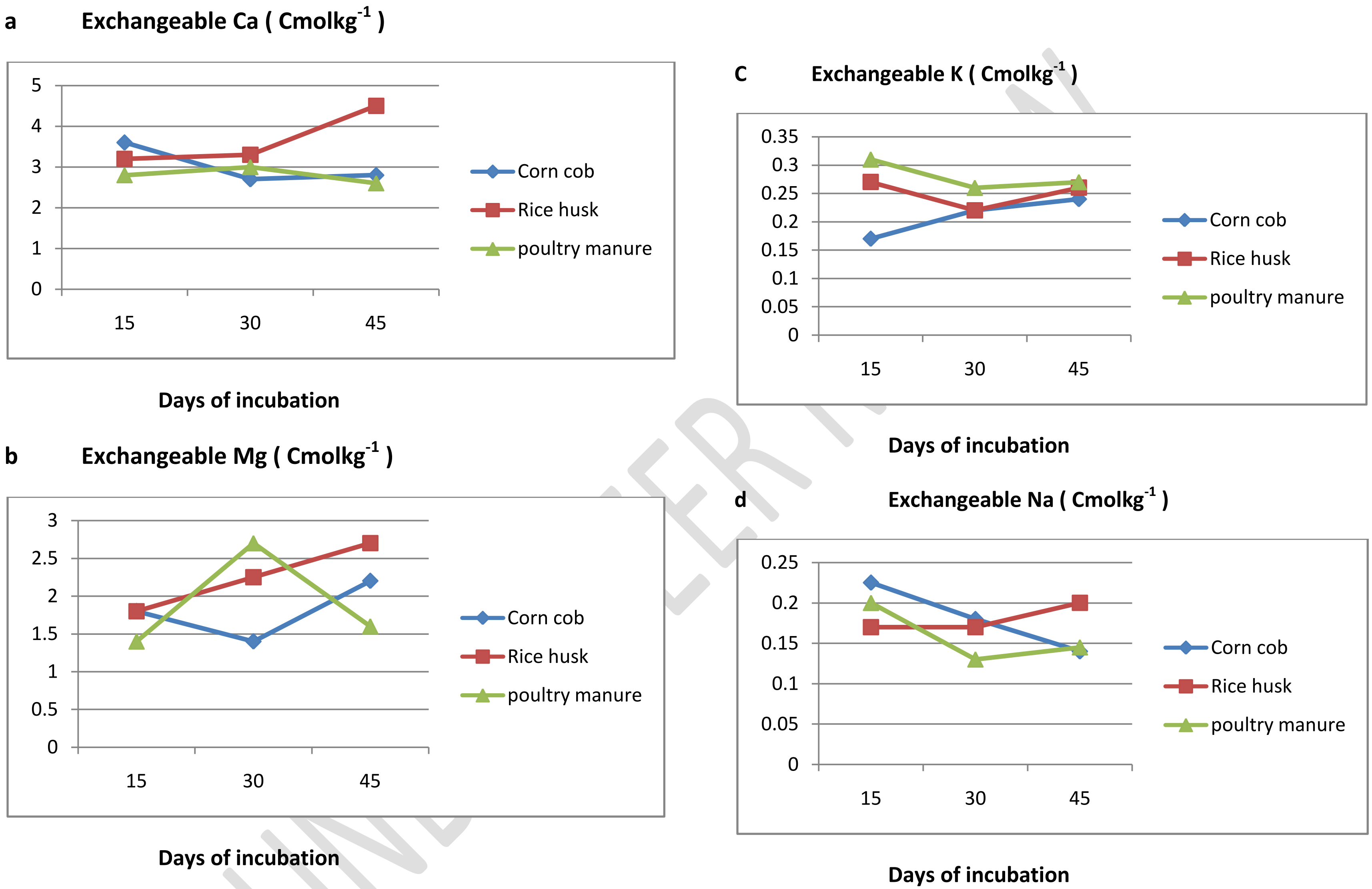

Figure 3; Effect of biochar at different incubation time on exchangeable Cations(Ca,Mg,K and Na).

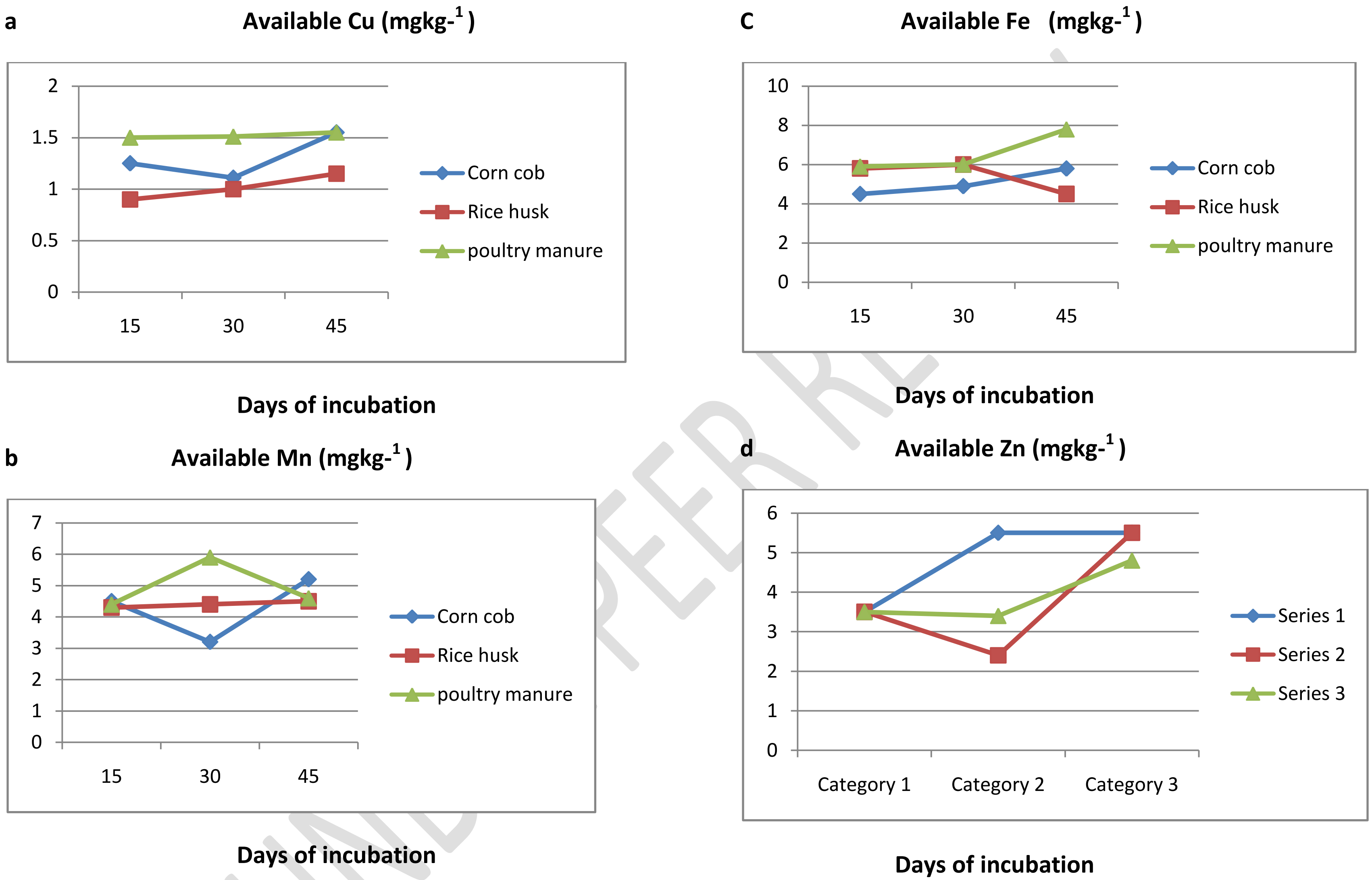

Figure 4; Effect of biochar at different incubation time on soil available micronutrients (Cu, Mn, Fe, and Zn).

Changes in mironutrient (Fe, Mn. Zn and Cu) content:

The results in relation to soil micronutrients (Fe, Mn, Zn and Cu) status due to effect of different biochar on soil after different intervals of incubation is presented in figure 4. The DTPA extractable Fe content showed a gradual increasing trend with time of incubation (Figure 4c). Application of CCB and PMB showed significant at all the intervals of incubation period although there was a slight drop at 30 DAI on PMB. Application of RHB recorded significant increase from 15 DAI (5.68 mgkg-l)to 30 DAI (5.96 mgkg-1) after which there was a decrease. The DTPA extractable Mn content showed gradual increase in RHB and PMB from 15 DAI (4.19 mgkg-1 and 4.740) to 30 DAI (4.09 mgkg-1 and 5.98 mgkg-l)which subsequently drop after 30 DAI. A decreasing trend was noticed on soil amended with CCB with respect to time of incubation from 15 DAI to 30 DAI, after which an increase was observed (Figure 4b).

Application of biochar showed significant ($P < 0.05$) differences in DTPA extractable Zn content in soil (Figure 4d). The DTPA extractable Zn content showed gradual decreasing trend with time of incubation from 15 DAI to 30 DAI in CCB and RHB application. Subsequently an increase was also observed in CCB and RHB after 30 DAI. A significant ($P < 0.05$) increase was observed in DTPA extractable Zn content on soil amended with PMB from 15 DAI to 30 DAI but a subsequent decrease was noticed at 45 DAI (Figure 4d). Application of biochars prior to incubation showed significant ($P < 0.05$) differences in DTPA extractable Cu content in soil. RHB and PMB amended soil showed a continuous gradual increase throughout the incubation period (Figure 4a). The DTPA extractable Cu content gradual decreasing trend was noticed with time of incubation in soil amended with CCB which after 30 DAI showed an increasing trend.

The variation in micronutrients content in soil with the application of different biochars can be attributed to their physical and chemical properties. Biochars by virtue of its high surface area, high metal affinity, higher nutrient retention capacity, presence of acidic and basic functional groups and ability to alkalize soil might result in precipitation of micronutrients in soil at early intervals of incubation up to 30 DAI. Such of these mechanisms of metal precipitation due to biochar application were also reported by Park et al. (2011). Although, there was an increase in micronutrients content over a period of incubation, due to mineralization of biochar increased the soluble organic carbon; thereby resulting in the mobilization of micronutrients. Micronutrient is strongly chelated by organic carbon and is less subjected to adsorption process. Beesley and Marmiroli (2011) also reported dependence of micronutrient content on soluble C and pH

4. CONCLUSIONS

Application of biochar resulted in positive effect on soil chemical properties. In highly acidic soils it may serve as a soil amendment by increasing the soil pH, P availability, exchangeable cations, CEC and OM and reducing exchangeable acidity in a sustainable manner. This study was done to evaluate the effect of different biochars on the amendment of the chemical properties of acidic soil. The study was conducted during the rainy season in 2022 in Imo State University Teaching and Research Farm using loamy sand with acidic pH (5.7). The soil was all collected from the same teaching and research farm. Soil was filled in separate plastic bucket with a lid (2 kg capacity) and treatments imposed as per the treatments details; Tl:Corn cob charred for 60 minutes at 20 t ha'^{1}, T2: Rice husk charred for 60 minutes at 20 t ha'^{1} and T3:Poultry manure charred for 60 minutes at 20 t ha'^{1}. The treatments were replicated thrice and then repeated for different days of incubation (15, 30 and 45 days respectively). The experiment was laid out in a completely randomized design (CRD). The results revealed that, application of different biochar increased the pH and other soil chemical properties evaluated with slight increase only in exchangeable K and Na and a decrease in exchangeable acidity (Al and H) of soil. From all biochar treatments, a good number of the soil chemical properties evaluated were significantly higher from plastic bucket treated with RHB at 20 t ha-1 followed by CCB at 20 t ha'^{1} and next was from PMB applied at 20t ha'^{1} After 45 days greenhouse incubation of different types of biochar the results revealed that during the incubation experiment changes were noticed, some nutrient elements showed a continuous increase with incubation time (exchangeable Al and H in Corn cob and Poultry manure biochar respectively) while some reached its maximum at the mid incubation time(CEC, BS, TN, AvP and OM in Poultry manure biochar). In some cases a decline was observed up to the mid incubation period after which an increase was observed(Exchngeable Ca and Mg in Corn cob biochar and Exchangeable K and Na in Rice husk biochar). Therefore this is particular importance as it indicates the value of biochar as alternative amendments to ameliorate acid soil management for acidic soils especially where farmers cannot afford liming or organic manure required.

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