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Effects of Tillage Systems and Organic Amendments on Nitrogen Mineralisation and Soil Erodibility in a Tropical Alfisol

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Abstract

Tropical soils are inherently low in fertility and highly susceptible to erosion, hence affecting crop productivity. Few studies have examined the effect of biochar from different sources and cow dung compost on tropical soils. This study assessed the influence of compost and biochar produced from cow dung and maize cobs on the physical and chemical properties of Alfisols. It investigated their mineralisation rates and the influence on the soil erodibility when these organic amendments are applied under different tillage practices. The experiment was laid out in a randomised complete block design during the 2018 wet and dry seasons. Soil amendments were 100% cow dung compost (A_{100}), 100% cow dung biochar (B_{100}), 50% cow dung compost and 50% cow dung biochar (AB_{50}), and a combination of the three amendments, i.e., cow dung biochar, cow dung compost, and maize cobs biochar at 33% each (C_{33}), and a control (D). Amendments were applied at 4 t ha^{-1}. Soils treated with B_{100} and A_{100} under conventional tillage had the highest total nitrogen and available phosphorus values of 3.92 g/kg and 10.37 mg/kg, respectively. The highest mineralisation rate was observed in soils treated with A_{100}, with 142.87 µgNg^{-1} under conventionally tilled soils. However, erodibility rate was lower under minimum tillage, with C_{33} having the lowest at 0.35. The results suggest that the combined application of cow dung and biochar under conventional tillage can improve soil fertility in the short term; however, minimum tillage would be a preferable alternative for long-term soil health and productivity.

Keywords: Tillage; Mineralization; Erodibility; Alfisol; Biochar

INTRODUCTION

Healthy soils exhibit nutrient cycling, water regulation, and carbon sequestration, thereby supporting sustainable crop production. Such soils possess beneficial organisms, reduce erosion, and help mitigate climate change. However, tropical soils, due to their weathered nature, are inherently low in nutrients and highly susceptible to erosion (Samuel et al., 2025). This poses challenges to sustainable agriculture in Sub-Saharan Africa. To meet global food demands in the region, there is a need to adopt agricultural practices that alleviate such challenges.

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Tillage practices aim to influence soil health and improve crop yield. Depending on the soil type and environment, each tillage system has varied effects on soil health and crop productivity (Srivastava, 2025; Thakur and Singh, 2025). Conventional tillage provides immediate benefits by improving crop yield, but may degrade soil structure and health over time. However, it could lead to soil compaction, reduced soil porosity, and increased susceptibility to erosion (Liu et al., 2025; Kumar et al., 2022; Jiang et al., 2025). Minimum tillage, however, aims to minimize soil disturbances by maintaining soil structure, leading to higher organic matter content, improved water infiltration, and enhanced soil biodiversity (Feng et al., 2025). Despite these benefits, it encourages weed emergence and pest issues (Kaur et al., 2025). To enhance crop productivity in the tropics, selecting an appropriate tillage system is important.

Tropical soils are inherently low in fertility. Additionally, the soils are highly susceptible to nutrient leaching (Vanolli et al., 2025). Climatic conditions, such as high rainfall and temperature, largely determine the vulnerability of these soils. However, incorporating appropriate organic amendments not only enhances their fertility but improve productivity. The application of these amendments will improve the soil physical properties, such as the soil aggregate stability, water infiltration, and moisture retention (Haufiku et al., 2025). Additionally, they improve soil chemical properties, increase nutrient availability, and stimulate microbial activity; hence, promoting biodiversity within the soil ecosystem (Ortiz-Carmona et al., 2026; Song et al., 2025).

Biochar, an amendment obtained from pyrolysis, improves soil properties and enhances soil nutrient retention. It has a large surface area and porosity, allowing it to absorb water and retain nutrients (Ali et al., 2025). This enhances nutrient availability for plants, increases water holding capacity, reduces bulk density, and increases soil organic carbon content (Birol and Gunal, 2025). Biochar stimulates microbial activity by providing favourable conditions for soil microorganisms, aiding nutrient cycling and decomposition of organic matter (Tang, 2025). Furthermore, biochar provides reactive surfaces that increase the availability of phosphorus (P) and potassium (K) in soils (Fathy et al., 2026). However, the effect of biochar is determined by the soil's physical and chemical properties, the type and rate of biochar application (Zhu et al., 2025). This also applies to other types of amendments, such as compost.

The addition of compost to the soil improves its physical, chemical, and biological properties. It increases the soil's cation exchange capacity (CEC), regulates the pH, and provides the soil with essential nutrients, such as nitrogen, phosphorus, potassium, etc. (Oueld Lhaj et al., 2025). Additionally, the benefits of compost application are both long-term and short-term. In tropical soils with declining soil fertility, compost can improve soil productivity and enhance crop performance (Ebido et al., 2024). By improving organic matter content, compost could help reduce soil susceptibility to erosion (Goldan et al., 2023).

Mineralisation of nutrients (especially nitrogen, phosphorus, and potassium) is necessary to improve soil fertility and crop productivity. However, rates of nutrient mineralisation are dependent on the nutritional composition and chemical properties of amendments (Reimer et al., 2023). For example, Sadi et al. (2019) noted that compost with a higher content of *Sida cordifolia* L. showed slower mineralisation rates in comparison with other composts. In addition, the soil texture and chemical properties also play a major role in nutrient mineralisation. To maximise the efficiency in tropical soils, the application rates and composition must align with plant needs. In tropical regions characterized by high temperatures and rainfall, this is essential in improving crop productivity. However, erodibility plays a vital role in ensuring these nutrients are retained or lost.

Soil erodibility is impacted by physical and chemical properties such as organic carbon, aggregate stability, bulk density, and infiltration capacity. Soil microbial activity and root density also play a major role by improving soil structure and erodibility (Larionov et al., 2018; Zhang et al., 2021). Hence, the higher the organic matter, the greater the structural cohesion, and the lower the soil erodibility. Due to the rapid decomposition of organic matter, tropical soils are increasingly vulnerable to erosion (Li et al., 2023). Alfisols, for instance, exhibit low structural stability, weak aggregation, and low organic matter (Salami et al., 2023). The high rainfall in areas where this soil type exists contributes to this vulnerability through its high kinetic energy impact on the soil surface (Ojo et al., 2023). Hence, tropical soils require appropriate soil management strategies, including the use of suitable organic amendments and tillage practices to mitigate this vulnerability.

Although there are studies on the impact of amendments on soil health and crop productivity, there is limited research on the mineralisation rates of biochar produced from different waste sources and compost. There is also limited research on their effect on the erodibility of tropical soils. This study investigated the effect of compost and biochar produced from cow dung and maize cobs on the physical and chemical properties of Alfisols. It also investigated the mineralisation rates of the amendments and their influence on soil erodibility.

MATERIALS AND METHODS

Description of field experiment

The study was carried out during the 2018 wet and dry seasons at the Teaching and Research Farm, Obafemi Awolowo University (OAU), Ile-Ife. The research farm was located at 07°30'0" N and 04°30'0" E, at an elevation of 268 m a.s.l. The study area falls within the lowland tropical rainforest. The experimental sites had a total annual rainfall of 1165.2 mm and an average annual temperature of 35.2°C (Komolafe, 2015). The early seasons have an average temperature of 28.57°C and 141 mm of precipitation; the late seasons have an average temperature of 26.49°C and 144.29 mm of precipitation (Climate Change Knowledge Portal, 2021). The experiment was carried out during the early cropping season (April – July) and late cropping season (September – December). The amendments used for the experiment were cow dung compost, cow dung biochar, and maize cob biochar. Soil amendment materials (maize cobs and fresh cow dung) were collected from the cropping site and the Beef Unit of the Teaching and Research Farm, OAU, Ile-Ife. The fresh cow dung was composted aerobically for three months to obtain the required compost. A measured quantity of the composted cow dung and maize cobs was charred to produce biochar. The production of the biochar was done using a local charcoal-fired reactor. The temperature range for charring the composted cow dung was between 400– 450^{0}C, while that of maize cobs was 300 to 500^{0}C.

The soil used for the experiment was classified using the USDA texture classification scheme as a sandy loam, belonging to the Iwo series, and an Alfisol. The experiment was made up of two locations; each consisting of three, 15.0 m x 2.5 m blocks. The first site was ploughed once for minimum tillage, while the second site was ploughed twice and harrowed once for conventional tillage. The experiment was laid out in a Randomized Complete Block Design (RCBD) consisting of 15 plots, each measuring 3.0 m x 2.5 m with an alley of 1.0 m between blocks and 1.0 m within plots. The amendments were 100% cow dung compost (A_{100}), 100% cow dung biochar (B_{100}), 50% cow dung compost and 50% cow dung biochar (AB_{50}), and a combination of the three amendments, i.e., cow dung biochar, cow dung compost, and maize cobs biochar at 33% each (C_{33}), and a control (D). Each amendment was applied at 4 t ha^{-1}, imposed at planting, and replicated thrice. Pre- and post- soil tests were done using standard methods. Throughout the experiment, weeds were managed using manual methods (hoe weeding and hand pulling).

Analyses of soil samples

Soil samples were collected before field trials and after each harvest. The samples were air-dried, crushed and sieved using a 2 mm mesh. Particle size distribution was determined using the hydrometer method (Bouyoucos, 1962). Soil pH was determined in a 1:1 soil to water suspension using the Dwyer model WPH1 waterproof pH tester. Organic carbon was determined using the Walkley-Black method (Walkley and Black, 1934). Total nitrogen was determined using the macro-Kjeldahl method (Jackson, Soil Chemical Analysis, 1962). Available phosphorus was determined using the Bray method (Bray and Kurtz, 1945). Exchangeable bases were determined using the method described by Thomas (1982). Concentrations of Ca, Mg, K and Na were obtained using Buck Scientific Atomic Absorption Spectrophotometer Model 210/211 VGP at various wavelengths (Ca at 422.7 nm, Mg at 285.2 nm, K at 766.5 nm and Na at 589.0 nm). The total sum of exchangeable bases (Ca^{2+}, Mg^{2+}, K^+, Na^+) gave the cation exchangeable capacity. This was determined using the method by Anderson and Ingram (1993).

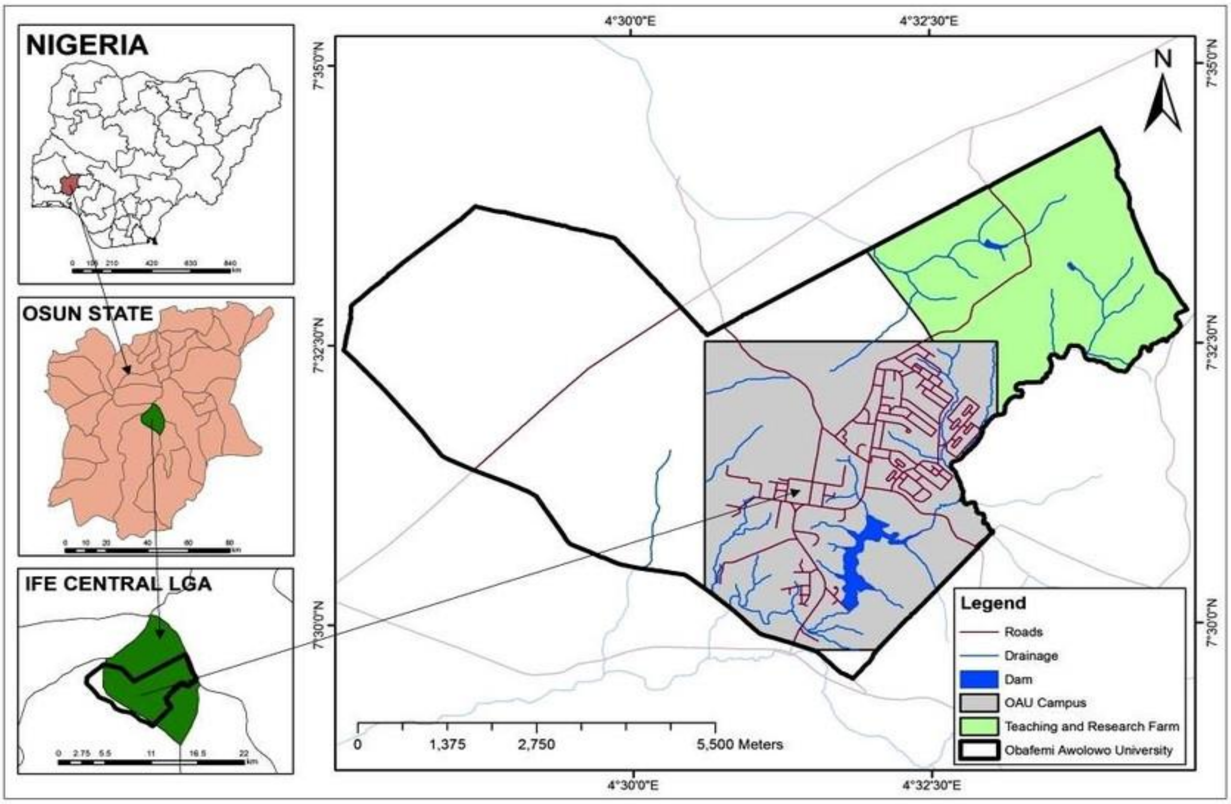

Figure 1: Map of Study Area

Analyses of organic amendments

The total nitrogen present in the compost and biochar used for the experiment was determined using macro-Kjedahl method (Jackson, 1962) and available Phosphorus by ascorbic acid molybdate blue method as described by Murphy and Riley (1962). The pH was determined in a 1 : 1 soil to water suspension using Dwyer model WPH1 water proof tester. Organic carbon was determined following wet digestion method as described by Walkley and Black (1934). After digestion with 1M ammonium acetate, Potassium was determined by reading with the flame photometer. Calcium and Magnesium were determined using the Buck Scientific 210/211 VGP AAS model after extraction with 1M ammonium acetate. Moisture and ash content were determined using standard methods.

Determination of soil erodibility

Top soil (0-15 cm) depth of the experimental plot was sampled and soil erodibility rate (K) was determined using standard method at planting, 6 weeks and 12 weeks after sowing on each plot using the equation by Fasinmirin & Olorunfemi, (2014).

$$K = 2.1x\ 10^{-4}\ M^{1.14}(12 - O_m) + 3.25(S - 2) + 2.5(P - 3) \quad (1)$$

(Fasinmirin & Olorunfemi, 2014)
Where
O_m = Organic matter
S = Soil Structure
P = Soil permeability Class, and
Soil texture M = (100- C) (S_{s1}+ S_{s2})
Where C = clay (%), S_{s1}= silt (%) and S_{s2} = sand (%)

Determination of soil structure and permeability

Soil structure was determined by taking soil samples from each sub plots using a soil auger and classified accordingly; 1. Granular, 2. Blocky, 3. Platy or massive, 4. Single grained. Soil permeability was determined by placing a column of soil under specific conditions such as water saturation and constant head while the permeability rate was measured in centimetres per hour.

Determination of mineralisation rate

Measurement of selected minerals such as N, P and K was calculated as the difference in the amount of nitrogen, phosphorus, potassium released between amended and control soils (Mohanty *et al*., 2011). The percentage of total N mineralized from each organic amendment at each sampling time was calculated as described by Azeez and Van Averbeke (2010) as follows:

$$\text{Mineralisation rate (\%)} = \frac{Ma - Mc}{Te} \qquad (2)$$

(Azeez and Van Averbeke, 2010)

where

Ma = Total mineralisation element for the amended soil,

Mc = Total mineralisation element the control and

Te = Total element in the applied organic amendment

Statistical analysis

Soil physical and chemical properties were subjected to two-way analysis of variance (ANOVA) using the GraphPad Prism software. Their treatment means was separated at 95% confidence limit using the Bonferroni post-hoc multiple comparison test.

RESULTS AND DISCUSSION

Table 1 shows the physical and chemical properties of the experimental site. The soil has a pH of 6.5, indicating a slightly acidic condition. This corresponds with the observation of Akinwunmi et al. (2022), who also noted that the Alfisols in the region are acidic. The organic carbon of the soil was 33.6 g kg^{-1}, total N was 3.8 g kg^{-1}, while available P was 21.61 mg kg^{-1}. The CEC of the site was 4.89 cmol kg^{-1} while the exchangeable acidity was 0.3 cmol kg^{-1}. The high organic carbon content can be attributed to the soil lying fallow for several years before cultivation. Żarczyński et al. (2023) noted that depending on the soil type, organic carbon could increase up to 20%. This corroborates the findings of Takim et al. (2023), who observed higher organic carbon in fallowed soils when compared to continuously cultivated arable crops. Low cation exchange capacity (CEC) in Alfisols is a significant factor affecting their soil fertility and nutrient retention (Minardi et al., 2023). Due to its low CEC, maintaining soil fertility would be difficult, hence the need for organic amendments.

The physical and chemical properties of the soil amendments used in the study are also presented in Table 1. The pH of the soil amendments ranged from 8.9 to 10.87, with maize cob biochar (MCB) having the highest pH of 10.87. This indicates their alkaline nature. Maize cob biochar had the highest organic carbon content of 465.3 g kg^{-1} when compared with cow dung biochar and cow dung compost with 389. 0 g kg^{-1} and 280.8 g kg^{-1}, respectively. The higher organic carbon observed in the maize cob biochar compared to other amendments is attributed to the lignin and cellulose present in the raw biomass (Shariff et al., 2016).

During the experiment, physical and chemical properties of amended soils improved compared to control (as shown in Tables 2 and 3). This study observed that soils treated with the combination of all three amendments (C_{33}) under minimum tillage had the highest soil pH of 7.6 when compared with other treatments under conventional tillage (Table 2). The increased soil pH observed under minimum tillage indicates that minimum tillage ensured that biochar, which is alkaline in nature, is less disturbed in the upper layer of the soil. This minimizes the leaching of the alkaline ions present in the biochar, subsequently neutralizing the soil acidity. These correspond with findings by Rodríguez-Vila et al. (2022), who observed that minimum tillage improved the soil pH of tropical soils compared to other tillage practices.

Table 1. Physical and Chemical Properties of Experimental Site and Organic Amendments.

Experimental Site		Organic Amendments			
Parameter	**Value**	**Parameter**	**CDC**	**CDB**	**MCB**
pH (1:1 Soil: H_2O)	6.5	pH	8.90	9.70	10.87
Organic Carbon (g kg^{-1})	33.6	Total Nitrogen (g kg^{-1})	13.40	11.70	0.70
Total Nitrogen (g kg^{-1})	3.80	Organic Carbon (g kg^{-1})	280.80	389.00	465.30
Available Phosphorus (mg kg^{-1})	21.61	C/N	21	33	664
Exchangeable acidity		Total Phosphorus (mg kg^{-1})	794.80	789.60	719.00
H^+	0.30	Potassium (cmol kg^{-1})	12.80	12.50	11.20
Al^{3+}	0.00	Ash content (%)	61.11	81.92	82.00
Exchangeable Cation (cmol kg^{-1}) Ca^{2+}	2.44	Moisture Content (%)	8.48	6.48	5.90
Mg^{2+}	0.75				
K^+	0.92				
Na	0.48				
Permeability (H m^{-1})	15				
Soil Structure (mm)	2				
Sand (g kg^{-1})	832				
Silt (g kg^{-1})	74				
Clay (g kg^{-1}) Textural class	94 Sandy Loam				

CDC = cow dung compost   CDB = cow dung biochar   MCB = maize cobs biochar

Table 2. Physical and Chemical Properties of Soil under Minimum Tillage at the End of the Late Cropping Season as Influenced by Soil Amendments.

Treatment	pH (H_2O)	OC g/kg	TN g/kg	AP mg/kg	EA	H	Ca cmol/kg	Mg	K	Na	Sand	Silt g/kg	Clay	Bulk Density ($g\ cm^{-3}$)
A_{100}	7.62a	25.56b	2.81b	5.04b	0.20b	0.20b	5.76a	0.27b	0.28c	0.27c	780.67b	134.00b	86.67c	1.43a
B_{100}	5.86b	23.55b	2.61c	3.83d	0.20b	0.20b	3.75d	0.43a	0.28c	0.29c	793.00b	153.00a	54.00e	1.40a
AB_{50}	7.54a	32.81a	3.62a	3.97d	0.32a	0.32a	4.12c	0.51a	0.36b	0.28c	784.67b	111.00b	104.33b	1.41a
C_{33}	7.67a	31.13a	3.01b	6.46a	0.12c	0.12c	5.51b	0.46a	0.41a	0.41b	826.33a	80.00d	93.67d	1.40a
D	5.46b	22.34b	2.41d	4.40c	0.20b	0.20b	2.76e	0.43a	0.31b	0.52a	776.67c	96.67c	126.67a	1.44a

Means followed by the same letter within a column in each block do not differ significantly at $p < 0.05$ according to Bonferroni's Multiple Comparison Test
A_{100} = CDC 100%, B_{100} = CDB 100%, AB_{50} = CDC 50%+ CDB 50% C_{33} = CDC 33.33 % + CDB 33.33 % + MCB 33.33 %, and D = Control.

Table 3. Physical and Chemical Properties of Soil under Conventional Tillage at the End of the Late Cropping Season as Influenced by Soil Amendments.

Treatment	pH (H_2O)	OC g/kg	TN g/kg	AP mg/kg	EA	H	Ca cmol/kg	Mg	K	Na	Sand	Silt g/kg	Clay	Bulk Density ($g\ cm^{-3}$)
A_{100}	7.48a	23.05c	2.51b	10.37a	0.32a	0.32a	2.93c	0.14c	0.41a	0.28a	801.67b	93.67c	104.67b	1.39a
B_{100}	5.75c	35.93a	3.92a	6.96c	0.16b	0.16b	5.11a	0.52a	0.43a	0.41b	761.33c	153.00b	85.67b	1.38a
AB_{50}	7.10b	33.42a	3.72a	6.75c	0.28a	0.28a	3.15b	0.29b	0.46a	0.26a	818.67b	54.67d	126.67a	1.41a
C_{33}	7.53a	27.17b	3.01b	6.60c	0.12b	0.12b	2.32c	0.34b	0.28b	0.28a	860.00a	73.33c	66.67c	1.40a
D	6.00c	22.95c	2.51b	7.38b	0.12b	0.12b	2.71c	0.10c	0.41a	0.57a	757.67c	173.33a	69.00c	1.38a

Means followed by the same letter within a column in each block do not differ significantly at $p < 0.05$ according to Bonferroni's Multiple Comparison Test
A_{100} = CDC 100%, B_{100} = CDB 100%, AB_{50} = CDC 50%+ CDB 50% C_{33} = CDC 33.33 % + CDB 33.33 % + MCB 33.33 %, and D = Control

However, cow dung biochar, when applied singly (B_{100}) under conventional tillage, achieved the highest value of 35.93 g/kg, improving the soil organic carbon content compared to other treatments under minimum tillage. This aligns with Tobiašová et al. (2023), who observed in their study that conventional tillage system had a higher organic carbon content in the short term when compared to reduced tillage. According to Lee et al. (2022), incorporation of biochar into the soil improves organic carbon content. Geng et al. (2022) also observed an increased carbon content when cow dung biochar was applied compared to other amendments. The increased organic carbon content observed under the conventional tillage indicates that it helps incorporate the amendments into the soil, increasing the connection between the biochar particles and the soil aggregates.

Macronutrients such as available phosphorus (AP), total nitrogen (TN), potassium (K), and exchangeable cations improved more under conventional tillage when compared to minimum tillage. For instance, soils treated with only cow dung biochar, under conventional tillage, had the highest total nitrogen (TN) value of 3.92 g/kg compared to other treated and control soils under minimum tillage. In addition, available phosphorus was highest in soils treated with 100% cowdung compost (A_{100}) with 10.37 mg/kg. However, conventional tillage had a lower bulk density compared to soils under minimum tillage. Apart from improving soil aeration, tillage accelerates the decomposition of organic matter, thereby ensuring nutrients are in available forms for plant uptake (Khan et al., 2025). This is in line with Pendke et al. (2025), who noted that conventional tillage improved soil fertility when combined with appropriate amendments such as manure. The lower bulk density observed in conventionally tilled soils could be attributed to a reduction in soil compaction due to the mechanical soil disturbance (Jabro and Stevens, 2022). Mechanical soil disturbance temporarily loosens the soil, disrupts compacted layers, and increases pore space immediately after cultivation. Under minimum tillage, less disturbance occurs, leading to a higher bulk density.

The rate of total nitrogen mineralisation is shown in Table 4. The highest mineralisation rate was observed in soils treated with cow dung compost (A_{100}) under conventional tillage. Soils treated with A_{100} had the highest mineralisation at 142.87 μgNg^{-1}, a 7.8% increase when compared to control. This was also observed in soils treated with A_{100} under minimum tillage, with a 4.9% increase compared to control soils. Soils treated with the combination of the three amendments had a slower mineralisation rate when compared to other treated soils, including control soils. The erodibility rates of control soils (D) were high when compared to other amended soils (as shown in Table 5). It was observed that soils treated with all three amendments (C_{33}) had a slower erodibility rate in both conventional and minimum tillage, followed by soils treated with cow dung compost (A_{100}). C_{33} soils under minimum and conventional tillage had 0.35 and 0.39, respectively. This was followed by A_{100} with 0.35 under minimum tillage and 0.44 under conventional tillage, respectively.

Compared to biochar, which has a recalcitrant nature, compost amendments are rich in labile organic compounds that are readily available to soil microbes (Leogrande et al., 2024). Hence, the observed higher mineralisation rate under conventional tillage is due to the mechanical incorporation of cow dung compost into the soil, making it more accessible to these microbes. This increases the rate of decomposition and conversion of organic nitrogen into plant available forms. This is supported by the study of Vilakazi et al. (2022). Vilakazi et al. (2022) observed that conventional tillage increased the decomposition of organic material and mineralisation of organic N when compared to other tillage systems. The ability of the soil to resist being detached or blown away by erosive forces is dependent on physical properties such as texture, organic matter, and permeability. Organic amendments such as cow dung and biochar improve soil structural ability and enhance aggregate cohesion (Dhiman et al., 2021; Khan et al., 2024).

Table 4. Effect of Different Tillage Practices on Mineralisation Rate of Soil Amendments.

Tillage	Treatment	MN (μgNg^{-1})	%
Minimum	A_{100}	113.00a	4.9
	B_{100}	112.01a	5.5
	AB_{50}	58.82b	1.9
	C_{33}	37.38d	1.1
	D	47.04c	0
Conventional	A_{100}	142.87a	7.8
	B_{100}	67.16b	2.5
	AB_{50}	9.80e	4.5
	C_{33}	18.69d	2.2
	D	38.03c	0

A_{100} = CDC 100%, B_{100} = CDB 100%, AB_{50} = CDC 50%+ CDB 50% C_{33} = CDC 33.33 % + CDB 33.33 % + MCB 33.33 %, and D = Control

Table 5. Effect of Tillage Practices and Soil Amendments on Soil Erodibility Rate.

	Treatment	O_m	Permeability	Soil structure	Erodibility Rate
Minimum	A_{100}	1.68	25.2	2	0.35
Tillage	B_{100}	2.16	15.6	2	0.45
	AB_{50}	1.58	19.0	2	0.37
	C_{33}	1.52	14.5	2	0.35
	D	2.12	13.8	2	0.51
Conventional	A_{100}	2.37	15.0	2	0.44
Tillage	B_{100}	2.12	16.4	2	0.51
	AB_{50}	2.10	19.5	2	0.45
	C_{33}	2.14	19.2	2	0.39
	D	1.56	20.5	2	0.61

A_{100} = CDC 100%, B_{100} = CDB 100%, AB_{50} = CDC 50%+ CDB 50% C_{33} = CDC 33.33 % + CDB 33.33 % + MCB 33.33 %, and D = Control

Hence, the lower erodibility rate observed in soils amended with biochar and compost is due to their complementary effect on the soil's physical structure. The improved physical structure provides greater resistance to particle detachment and transport by erosive forces. Findings by Ekwealor et al. (2020) also reported that combined application of cow dung with other amendments improved the soil's resistance to erosion.

CONCLUSION

This study investigated the effect of both minimum and conventional tillage practices, different organic amendments, and their combination on the properties, nitrogen mineralisation, and erodibility rates of an Alfisol. Although the combined application of compost and different biochar sources from maize cobs and cow dung had a slower mineralisation rate, the study observed that it improved the soil physical properties and reduced the soil erodibility rate in both the short and long term. Although conventional tillage improved soil properties when compared to minimum tillage, it is preferable in the short term for improved crop productivity. However, the slower mineralisation and erodibility rate observed in minimum tillage suggests it is a better alternative for long-term agricultural productivity in Alfisols.

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