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RESIDUAL EFFECTS OF SELECTED ORGANIC MULCHES ON SOIL PHYSICO-CHEMICAL PROPERTIES AND YELLOW PEPPER (*Capsicum chinense*) YIELD IN A DERIVED SAVANNAH, SOUTHEASTERN, NIGERIA

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ABSTRACT

The residual effects of organic mulches on soil fertility and crop yield are underexplored in the Derived savannah soils of southeastern Nigeria. This study investigated the residual influence of selected organic mulch materials on the physico-chemical properties of soil and the yield of yellow pepper (Capsicum chinense) one year after the application. The research was conducted at the Department of Soil Science and Land Resources Management Research Farm, Nnamdi Azikiwe University, Awka. The experimental design was a Randomized Complete Block Design (RCBD) with four treatments (oil palm fiber - OPF, rice husks - RH and neem leaves - NL - Azadirachta indica A. Juss. and a control), replicated five times. Soil samples collected at 0-15 cm were analyzed using standard analytical procedures; data on plant parameters were also collected. The collected data were subjected to Analysis of Variance (ANOVA) using Genstat 4th edition, means were separated using the Least Significant Difference at a 5% level of probability. Results indicated that NL significantly enhanced soil pH, total nitrogen, available phosphorus, calcium, magnesium, effective cation exchange capacity, and base saturation. In contrast, RH improved soil organic carbon and resulted in the highest fruit yield (2.2 t/ha). NL enriched soil fertility more effectively than the other mulches, likely due to the favorable decomposition and nutrient release patterns of both OPF and RH. This study recommends RH and NL as the cost-effective and locally available mulching options for sustainable pepper production in southeastern Nigeria.

Keywords: Yellow pepper, soil fertility, organic mulches, growth, yield.

1. INTRODUCTION

Mulching is a critical agricultural practice that involves covering the soil surface with organic and inorganic materials to enhance moisture retention, suppress weed growth, and improve soil productivity (Iqbal *et al*., 2020). Organic mulches are globally recognized for their contributions to soil structure, nutrient cycling, carbon sequestration, and erosion control (Marble *et al*., 2017; Lal, 2019, Amelung *et al,* 2020). Notably, organic mulches effectively mitigate soil salinity and promote desalinization by improving water retention and reducing evaporation, thereby aiding in the reclamation of saline soils (Iqbal *et al*., 2020). The application of organic mulches positively impacts crop productivity by decreasing greenhouse gas emissions from the soil and enhancing carbon sequestration, particularly when organic materials are employed (Chan *et al*., 2020).

Various organic mulches, such as leaves from arborvitae, eucalyptus, pine, etc., have been identified as being effective in removing heavy metals from soil solutions (Iqbal *et al*., 2020). Wang *et al*. (2020) highlighted the role of organic mulches in moderating soil temperature, insulating the soil and minimizing fluctuations that can adversely affect microbial activity and root development. Additionally, organic mulches function as barriers against direct sunlight, thereby retaining soil moisture and reducing evaporation (Zhang *et al*., 2019). As these mulches decompose, they release essential nutrients, including nitrogen, phosphorus, and potassium, which enhance soil fertility (Xie *et al*., 2021). Lal (2019) noted that organic mulches diminish the impact of raindrops on soil, thereby reducing surface runoff and erosion. Over time, they also buffer soil pH, creating a more conducive environment for plant growth (Yakovchenko *et al*., 2017), while improving soil structural stability, nutrient availability, porosity, and water infiltration (Abiven *et al*., 2017).

In Nigeria, pepper (Capsicum species) is a significant vegetable and spice crop, valued for its culinary, medicinal, and economic benefits (Sintayehu *et al*., 2015); yet its productivity has declined due to diminishing soil fertility, pest pressures, and abiotic stresses (Abubakar, 2015; Abdulmalik *et al*., 2012). The average yield for farmers (9 t/ha) remains below the potential yield (15 t/ha) observed in research-managed systems (Jaliya and Sani, 2006). This decline has been attributed to various biotic and abiotic factors, including weeds, pests, diseases, and environmental stresses (Abdulmalik *et al*., 2012; Jaliya and Sani, 2006).

However, its growth is often hindered by low organic matter content and acidity in the derived savannah soils. *C. chinense* is a rich source of vitamins A, C, and E, as well as thiamine, vitamin B6, beta carotene, and folic acid (Nadeem *et al*., 2011). Its taproot system enhances aeration, water infiltration, and nutrient uptake, thereby improving soil health (Huang *et al*., 2013). Sintayehu *et al*. (2015) observed a potential yield increase in yellow pepper when mulched with dry coffee husk and vetiver grass, particularly in conjunction with the Melka Awaze variety. While the effects of fresh mulch applications on soil and crop performance have been extensively studied (Antonio *et al*., 2010; Marwan, 2021; Mingming *et al*., 2010), there is limited research on their residual impacts, particularly concerning effects that persist into subsequent cropping seasons without reapplication. Understanding these residual effects is vital for sustainable, low-input farming systems, especially in contexts where farmers may be unable to afford repeated mulching. This study aims to evaluate the residual effects of selected organic mulching materials on soil physico-chemical properties and their influence on the growth and yield of yellow pepper.

2. MATERIALS AND METHODS

Description of the study area

The experiment was conducted at the Soil Science and Land Resources Management demonstration farm, Faculty of Agriculture, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria. Awka is situated at latitude 6° 24' N and longitude 7° 11' E, with an altitude of 422 meters. The area experiences an average annual rainfall of 1650 mm to 2000 mm per annum, a mean temperature of 27°C to 30°C, and relative humidity of 75 to 80% (Ezenwaji *et al*., 2014). The climate is characterized by two distinct seasons: the rainy season (April to October) and the dry season (November to March), with a notable break in rainfall occurring in August. Common weeds observed in the experimental farm include *Sida acuta, Senna occidentalis, Sclerocarpus* *africanus, Asystasia gangetica, Imperata cylindrical, Nelsomia canescens, Aspilia africana, and Mimosa pudica.*

Experimental Design and Layout

The study was carried out in an established experimental field measuring 11 m by 7 m (77 m^2), planted with yellow pepper at a spacing of 30 cm x 60 cm. The layout consisted of 20 plots, each measuring 1 m by 1 m, arranged in a Randomized Complete Block Design (RCBD) with four treatments (OPF, RH, NL, and control), replicated five times. Each plot received a blanket treatment of 10t/ha poultry manure and an equal quantity of treatment at 4 kg per plot (40 tonnes/hectare) of oil palm fiber, rice husk, neem leaves, and a control.

Soil Sampling and Preparation

Soil samples were collected from various locations within the experimental plot, totaling 20 samples using an auger at a depth of 0-15 cm, in accordance with the rooting depth of yellow pepper. The samples were air-dried and passed through a 2 mm sieve in readiness for analysis.

Laboratory Analysis

Soil Physical Properties

Particle Size Distribution was determined using the Bouyoucus hydrometer method (Bouyoucus, 1965) with Calgon as the dispersant. The soil textural class was identified using a textural triangle. Soil Moisture Content was determined by the gravimetric method as modified by Jacinto *et al*. (2017). Bulk Density was measured using the core method as described by Grossman and Reinsch (2002); while total porosity was calculated from bulk density as: 1-bd/pd where bd = Bulk density and pd = Particle density. Hydraulic conductivity was determined by the constant head permeability procedure according to Young (2001) and as described by Udo, *et al* (2009) and computed using Darcy's equation as: $K_{sat} = QL/AT\Delta H$

Soil Chemical Properties

The Soil pH was determined with a digital pH meter in a supernatant suspension of 1:2.5 soil: water ratio, as described by Udo *et al* (2009).

Exchangeable Acidity (hydrogen and aluminum ions) was extracted by 1N KCl extraction method and determined by titrimetric method using 0.005N NaOH and 1% phenolphthalein as an indicator as outlined by Udo *et al.* (2009).

Organic carbon was determined by Walkley and Black wet oxidation method using barium solution as indicator as outlined by Nelson and Somner (1996); and was calculated as:

Soil OC = Me K2Cr207 - MeFS04 x 0.003 x 100 (F)/Mass of air dried soil used

Where F = Correction factor; Me = Normality of solution x volume used.

Exchangeable bases (K^+, Ca^{2+}, Na^+, and Mg^{2+}) were determined using Thomas 1982 method as demonstrated by Jones, (2001). The amount of Ca and Mg were determined using Ethylene Diamine Tetra-Acetic (EDTA) titration method while potassium and sodium were determined by flame photometer (Rhoades, 1982)

Available phosphorus was determined using Bray 2 method according to Bray and Kurtz (1945) and Available phosphorus was measured using a spectrophotometer.

Total nitrogen was determined by the Macro- Kjeldahl method as modified by Udo *et al.*, (2009) and the Nitrogen content was determined by titration using standard HCl.

Effective Cation Exchange Capacity (ECEC) was calculated as the summation of exchangeable cations and the exchangeable acidity measured in the soil (Exchangeable Ca^{2+}, Mg^{2+}, Na^{+} and K^{+}) + Exchangeable acidity (H^{+}, Al^{3+}). ECEC = TEB + TEA

Percentage Base saturation was calculated as: TEB/ECEC × 100/1

Where TEB = Total Exchangeable Bases; ECEC = Effective Cation Exchange Capacity.

Yield Data Collection

Four middle plants from each plot were tagged as the experimental units, and data were collected on the number of fruits and overall fruit yield.

Statistical Analysis

Data collected were subjected to analysis of variance (ANOVA) for the Randomized Complete Block Design (RCBD) using Genstat 4th edition (2011). Significant means were separated using Fisher's Least Significant Difference (F-LSD) at a 0.05 probability level.

3. RESULTS AND DISCUSSIONS

Nutrient Composition of the Mulch Materials and Poultry manure used in the experiment

The nutrient composition of the mulch materials and poultry manure used in this study is presented in Table 1. The carbon-to-nitrogen (C/N) ratio is crucial for optimizing soil fertility; a ratio of 24.1 effectively stimulates microbial activity, promoting rapid decomposition of organic residues and subsequent nutrient release for plant growth and development. Among the materials tested, only oil palm fiber (OPF) achieved the ideal C/N ratio of 24.1. Poultry manure served as a blanket treatment, while all mulch materials exhibited slightly acidic pH levels, ranging from 5.7 to 6.2.

Table 1: Nutrient Composition of Mulch Materials and Poultry manure used in the study

Nutrient	PM	OPF	RH	NL
pH	8.8	5.7	6.2	5.8
Nitrogen (%)	3.6	1.52	1.34	2.98
Phosphorus (mg/kg)	2.22	1.86	0.88	1.10
Potassium(cmol/kg)	1.4	0.97	0.91	1.28
Calcium (cmol/kg)	0.88	0.60	0.52	0.66
Magnesium(cmol/kg))	0.52	0.40	0.38	0.44
Sodium(cmol/kg)	0.33	0.24	0.22	0.29
Organic matter (%)	38.02	37.64	31.43	36.47
C/N ratio	10.6	24.8	23.5	12.2

Source: Uko et al., 2021

PM = Poultry Manure; OPF = Oil Palm Fibre; RH = Rice Husk; NL = Neem Leaves

Effect of Organic Mulch on Selected Soil Physical Properties

The results of the residual effects of selected organic mulches on soil physical properties are summarized in Table 2a, while Table 2b presents the effects of organic mulches on these properties. The data indicate that particle size distribution was not significantly affected by mulching, likely due to the duration of the experiment. This finding aligns with Jinshi *et al.*

(2018), who noted reduced soil loss through sedimentation with higher application rates of organic mulch. Additionally, Zhang *et al*. (2019) observed that organic mulches can increase silt and clay fractions while decreasing sand fractions, which is consistent with our observations (Tables 2a and 2b).

The plot mulched with rice husk exhibited the highest moisture content (28.92%), followed by neem leaves (24.4%) and oil palm fiber (22.98%). The control plot recorded the lowest moisture content (18.8%). The results in Table 2a demonstrate that organic mulch had a significant effect on moisture content ($p < 0.05$), corroborating the findings by Goitom *et al*. (2017), who reported increased soil moisture with higher rates of organic mulch in potato production in the central highlands of Kenya.

As shown in Table 2a, the highest bulk density (1.42 g/cm^3) was observed in the control plot, followed by oil palm fiber (1.34 g/cm^3), while the rice husk and neem leaves plots recorded the lowest densities. The increase in pore space observed in this study, resulting from reduced bulk density, could be attributed to the ability of organic mulch to mitigate soil compaction and protect the soil surface from direct raindrop impact. These findings are consistent with Rafia *et al*. (2022), who reported improved bulk density and increased pore spaces due to enhanced organic matter and aggregate stability from organic mulching.

The highest porosity was recorded in the neem leaves mulched plot (50.94%), followed by rice husk (50.28%) and oil palm fiber (49.54%), while the control plot exhibited the lowest total porosity (46.19%). Total porosity showed a significant increase ($p < 0.05$) across mulched plots compared to the control, corroborating the findings by Li *et al*. (2020) regarding soil porosity.

For hydraulic conductivity (Ksat), a significant increase ($p < 0.05$) was observed across plots mulched with different organic materials compared to the control. The highest Ksat value (17.4 cm^3/hr) was recorded in the neem leaves mulched plot, followed by rice husk (16.22 cm^3/hr) and oil palm fiber (14.4 cm^3/hr), while the control recorded the lowest value (9.4 cm^3/hr). The observed increase in hydraulic conductivity may be attributed to the decomposition of organic mulch, which creates more space for water movement through soil pores. Similar results were reported by Nwosu and Eke-Okoro (2016), that organic mulch enhanced soil porosity, thereby improving saturated hydraulic conductivity.

Table 2a: Residual Effects of Organic Mulch on Selected Soil Physical Properties

Treatment	Sand %	Silt %	Clay %	Texture	MC %	BD g/cm^3	TP %	Ksat cm/hr
Oil Palm fiber	73.6	11.6	14.8	SL	22.98	1.34	49.54	14.4
Rice husk	73.8	11.4	14.8	SL	28.92	1.32	50.28	16.22
Neem leaf	73.4	11.4	15.2	SL	24.4	1.30	50.94	17.4
Control	73.2	11.4	15.4	SL	18.8	1.42	46.19	9.4
LSD (0.05)	NS	NS	NS	-	0.26	0.02	0.74	0.39

Table 2b: Effect of organic mulch on Selected Soil Physical properties

Treatment	Sand (%)	Silt (%)	Clay (%)	Texture	MC (%)	BD (g/cm^3)	TP (%)	Ksat (cm/hr)
Oil Palm fibre	73.8	11.6	14.6	SL	21.4 1	1.4	48.5	13.6
Rice husk	73.8	11.4	14.8	SL	26.2 1	1.3	49 .2	15.4
Neem leaf	73.4	11.0	15.6	SL	22.6	1 .3	49 .5	16.2
Control	73.2	11.4	15.4	SL	18.6	1.4	47.7	9.6
LSD (0.05)	NS	NS	NS		0.99	0.02	0.33	0.37

Source: Uko et al., 2021

MC = Moisture Content; BD = Bulk density; TP = Total porosity; Ksat = hydraulic conductivity; LSD = Least Significant Difference; NS = Not significant

Effect of Organic Mulch on selected Soil Chemical properties

The residual effects of selected organic mulches on soil chemical properties are presented in Table 3a, while Table 3b outlines the effects of organic mulches on these properties.

pH

The highest pH was recorded in the plot mulched with neem leaves (6.2), followed by oil palm fiber (5.98), rice husk (5.76), and the control (4.8). Significant differences ($p < 0.05$) were observed across the mulched plots, indicating the influence of organic mulches even after some time (Table 3a). The observed increase in pH may be attributed to the mineralization and nutrient release from the mulch materials used, aligning with Patil *et al*. (2013), who reported similar increases in pH and soil nutrients from rice husk application.

Available Phosphorus

Different organic mulches positively affected available phosphorus (Table 3a). Neem leaves had the highest available phosphorus (24.14 mg/kg), followed by oil palm fiber (22.5 mg/kg) and rice husk (21.46 mg/kg), while the control recorded the lowest (13.32 mg/kg). The significant difference ($p < 0.05$) in available phosphorus among mulched plots compared to the control is likely due to phosphorus released from the gradual decomposition of the organic materials. This finding is consistent with Li *et al*. (2021), who observed similar increases in phosphorus levels in straw-mulched plots.

Total Nitrogen

Total nitrogen was highest in the neem leaves mulched plots (0.33%), followed by oil palm fiber (0.31%) and rice husk (0.29%), with the control exhibiting the least (0.07%). A significant increase in total nitrogen ($p < 0.05$) was noted among the mulched plots compared to the control. This increase can be attributed to the gradual decomposition of organic mulches, which releases nitrogen into the soil. These results align with Li *et al*. (2021), who reported similar increases in nitrogen levels under organic mulch.

Organic Carbon

Organic carbon showed a significant effect ($p < 0.05$) among the mulched plots compared to the control. Rice husk mulched plots had the highest organic carbon (2.79%), followed by oil palm fiber (1.76%) and neem leaves (1.59%), while the control recorded 0.76%. The increase in organic carbon among the mulched plots may stem from the availability of organic material on the soil surface, as noted by Pazhanivel *et al*. (2024), who reported significant positive effects on organic matter in rice husk-treated plots.

Calcium and Magnesium

The highest values for calcium and magnesium were observed in neem leaves mulched plots (9.02 cmol/kg and 4.46 cmol/kg), followed by oil palm fiber (7.94 cmol/kg and 4.04 cmol/kg), and the lowest was observed in rice husk (7.22 cmol/kg and 3.18 cmol/kg). Both Ca^{2+} and Mg^{2+} were significantly affected ($p < 0.05$) by the organic mulches compared to the control (2.64 cmol/kg and 0.56 cmol/kg). The increase in calcium can be attributed to the gradual decomposition of the organic mulch materials, consistent with findings by Patil *et al*. (2013) and Edward (2018) which they observed increased most soil nutrients and subsequently induced early maturity in tomato and improved maize crop performance respectively.

Potassium and Sodium

The highest potassium and sodium values were recorded in plots mulched with oil palm fiber (0.34 cmol/kg and 0.31 cmol/kg), followed by neem leaves (0.33 cmol/kg and 0.30 cmol/kg), and rice husk (0.31 cmol/kg and 0.29 cmol/kg). The control had the lowest values (0.07 cmol/kg). Significant increases ($p < 0.05$) in potassium and sodium levels were observed in mulched plots compared to the control, corroborating the findings by Bingpeng *et al*. (2019) and Sales (2015) who reported an increase in the amount of available K^+ under mulched experiment and improved sodium absorption ratio, significantly mitigating soil salinity and sodicity level respectively.

Hydrogen and Aluminum

The use of different organic mulches negatively impacted the concentrations of hydrogen and aluminum ions in the soil. Hydrogen ion concentrations (H^+) ranged from 0.64 to 1.43 cmol/kg, while aluminum ion concentrations (Al^{3+}) ranged from 0.32 to 0.82 cmol/kg. The highest H^+ concentration was in the control plot (1.43 cmol/kg), followed by rice husk (0.85 cmol/kg) and oil palm fiber (0.71 cmol/kg), with the lowest in neem leaves (0.64 cmol/kg). The observed increase in H^+ and Al^{3+} concentrations may lead to decreased pH values, potentially tying up soil nutrients. This finding slightly contrasts with Uko *et al*. (2021), who reported significant decreases in H^+ and Al^{3+} concentrations under organic mulch.

Effective Cation Exchange Capacity (ECEC) and Base Saturation (BS)

Plots mulched with neem leaves had the highest ECEC and base saturation (15.07 cmol/kg and 93.59%), followed by oil palm fiber (13.69 cmol/kg and 92.25%), and rice husk (12.27 cmol/kg and 89.63%). The lowest values were found in the control (5.59 cmol/kg and 59.66%). ECEC was significantly affected ($p < 0.05$) by the organic mulches, likely due to the decomposition of the organic materials, which released nutrients and increased the soil's capacity to hold positively charged ions. This observation aligns with the findings by Akpan and Iliyasu (2018), who noted increased basic cations in acid sands due to organic mulch application. The observed increases in

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nutrient levels in the mulched plots can be attributed to the gradual decomposition and mineralization of the organic mulch materials used in the experiment. However, the interference from the concentrations of H^+ and Al^{3+} ions may have hindered the adequate release of these nutrient elements. This interaction suggests that while organic mulches can enhance soil fertility, the presence of high levels of hydrogen and aluminum ions could limit nutrient availability, impacting overall soil health and plant growth.

Table 3a: Residual Effect of Different Organic Mulch on selected Soil Chemical properties

Mulch material	pH	Av.P mg/kg	N g/kg	OC g/kg	Ca^{2+}	Mg^{2+}	K^+	Na^+	H^+	Al^{3+}	ECEC	BS %
					…….cmol/kg ……….							
Oil palm fiber	6.0	22.5	3.1	17.0	7.94	4.04	0.34	0.31	0.71	0.35	13.69	92.25
Rice husk	6.0	21.5	2.9	27.1	7.22	3.18	0.31	0.29	0.85	0.42	12.27	89.63
Neem leave	6.2	24.14	3.3	15.9	9.02	4.46	0.33	0.30	0.64	0.32	15.07	93.59
Control	4.8	13.32	0. 7	7.6	2.64	0.56	0.07	0.07	1.43	0.82	5.59	59.66
$LSD_{(0.05)}$	0.14	0.51	0.002	0.19	0.34	0.15	0.004	0.005	0.09	0.06	0.41	1.36

Av.p = Available phosphorus, TN = Total nitrogen, OC = Organic carbon, Ca2+ = Calcium, Mg = Magnesium, K = Potassium, Na = Sodium, H+ = Hydrogen, Al3+= Aluminum, ECEC = Effective Cation Exchange capacity, BS = Base saturation, LSD = Least Significant Difference

Table 3b: Effect of different organic mulch on selected soil chemical properties

Mulch material	pH	Av.P mg/kg	N g/kg	OC g/kg	Ca^{2+}	Mg^{2+}	K^+	Na^+	H^+	Al^{3+}	ECEC	BS %
						…….cmol/kg ……….						
Oil palm fiber	6.1	21	4.0	19.0	8.5	4.5	0.4	0.3	0.4	0.2	14.2	96.4
Rice husk	5.8	20	3.0	29.0	7.8	3.6	0.4	0.3	0.5	0.2	12.8	94.4
Neem leave	6.3	23	4.0	18.0	9.5	4.9	0.4	0.30	0.3	0.1	15.5	97.3
Control	4.9	14	1.0	10.0	2.9	0.8	0.1	0.1	1.1	0.6	5.6	69.7
$LSD_{(0.05)}$	0.12	0.86	0.01	2.0	0.22	0.17	0.003	0.005	0.04	0.04	0.3	0.86

Source: Uko et al., 2021

Total Number of Fruits

The total number of fruits at harvest (Fig. 1) ranged from 156 to 375. The plot mulched with rice husk produced the highest number of fruits (375), followed by oil palm fiber (333), while the neem leaves mulched plots yielded 324 fruits, significantly more than the control, which had only 156 fruits. The increase in fruit number observed in the mulched plots can be attributed to the gradual release and supply of nutrients from the various organic mulch materials applied. This finding aligns with the results of Goitom *et al*. (2017), who investigated the effects of organic mulching on soil moisture, yield, and yield-contributing components in sesame.

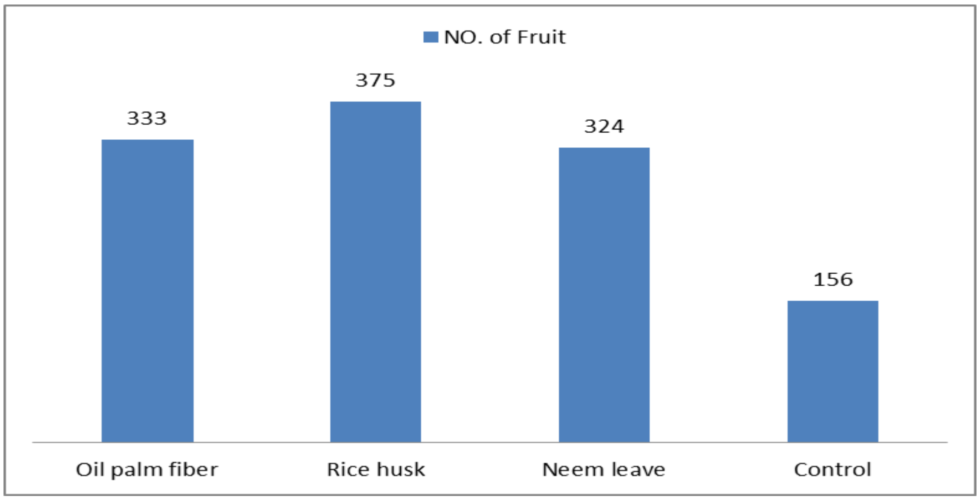

Fig. 1: Total Number of Fruits

Total Yield of Pepper

Figure 2 illustrates that total pepper yield ranged from 0.76 kg/plot to 2.2 kg/plot, resulting from the application of different organic mulches and allowing them to decompose over approximately one year without further application. The highest yield was recorded in plots mulched with rice husk (2.2 kg/plot), followed by oil palm fiber (1.83 kg/plot), while the lowest yield among the mulched plots occurred in those with neem leaves (1.55 kg/plot). Total yield varied significantly ($p < 0.05$) compared to the control, which yielded only 0.76 kg/plot. The increase in yield observed in this study can be attributed to the high nutrient content of the organic materials used as mulch. This finding is consistent with the report by Vanella *et al*. (2024), who noted increased orange yield from the application of various organic mulches in a Mediterranean climate.

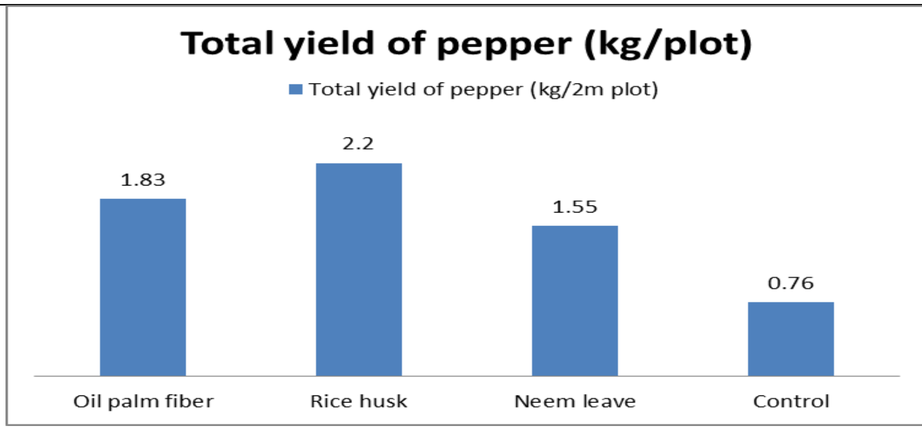

Fig. 2: Total yield of pepper (t/ha)

Table 4: Effects of different mulch material on total yield of pepper

Mulch material	(t/ha)
Oil palm fiber	1.83
Rice husk	2.2
Neem leave	1.55
Control	0.76
LSD (0.05)	0.59

4. CONCLUSIONS AND RECOMMENDATIONS

The study demonstrates that different organic mulches have varying effects on both the physico-chemical properties of soil and the yield of yellow pepper (*Capsicum chinense*). The application of organic mulches significantly improved soil characteristics such as moisture content, total porosity, and hydraulic conductivity, even after the mulch materials were removed. It was generally observed that there was an increase in selected soil physical parameters measured (the moisture content, bulk density, porosity, and hydraulic conductivity) as residual (Table 2a) compared with what obtained when the mulches were applied (Table 2b). This could be as a result of the decomposition of the organic mulch materials enhancing the organic matter content which improved the soil moisture content, porosity, hydraulic conductivity and reduced the bulk density.

This enhancement supports sustainable organic agriculture and contributes to increased yields of yellow pepper. Notably, the highest number of fruits was recorded in plots mulched with rice husk, followed by those mulched with neem leaves. Additionally, the highest levels of nitrogen (N), phosphorus (P), and potassium (K) were found in plots mulched with neem leaves. Based on these findings, this study recommends the use of rice husk and neem leaves as mulch materials for the production of yellow pepper (*Capsicum chinense*). These options are both economical and readily available, and they significantly improve yield and soil health.

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