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INFLUENCE OF DIFFERENT TILLAGE PRACTICES ON SOIL PROPERTIES AND GROWTH OF MAIZE VARIETIES ON TYPIC PLINTHUSTALF SOIL

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ABSTRACT

It is of upmost importance to understand soil properties in order to adopt most appropriate tillage practice as a soil management option for sustainable crop production. For this purpose, a study was conducted to determine influence of tillage practices on soil properties under maize cultivation in 2016 and 2017 cropping seasons on Typic Plinthustalf soil in Malete, Kwara State. Tillage practices evaluated were No-till, Single plough and Plough + harrow. The results showed that bulk density of entire surface samples under the three tillage practices were desirable for agricultural use (1.5 – 1.7 g/cm^3) while their total porosity ranged from 36 – 43 %. Soil inherent capacity indicators: texture, permeability and bulk density of study area reflected a suitable agricultural soil regardless of soil manipulation processes. Preference was in order of plough+harrow>plough>No till in growth parameters. Also, physical and chemical properties of surface soil from No-till plots greatly influenced maize performance evidenced in lateness to 50 % anthesis and silking. Soil dynamic properties variability such as CEC, pH, OC, macro and micro nutrients were in order of No till>plough>plough+harrow. However, considering results obtained from this study, tillage practice centered on Plough+harrow can successfully promote sustainable management of Typic Plinthicustalf soil of Malete, in Kwara State under maize cultivation.

Keywords: Soil capacity; soil environment; soil type; tillage practices

INTRODUCTION

Maize (*Zea mays* L.) is a cereal crop that is grown widely throughout the world in a range of agro-ecological environments and generally called **"**corn". Although it is a grain crop, it is consumed as a vegetable (Onwueme and Sinha, 1999). The grains are rich in vitamins A, C and E, carbohydrates, and essential minerals, and contain 9 % protein (Rowland, 1993). They are also rich in dietary fiber and calories which are a good source of energy. All parts of the crop can be used for food and non-food products.

However, Aikins *et al*. (2012) reported that a number of factors constrain maize production in Africa which includes declining soil fertility, little or inadequate use of chemical fertilizers, poor disease and pest control, and inappropriate tillage practices among others. Generally, ideal conditions for maize production are average temperatures of 20 – 23

°C, deep, well-drained, fertile soils and 500 – 1100 mm rainfall during the growing season (5.1 – 10.2 cm).

In a specific assertion, Rosner *et al*. (2008) reported that insect pest, diseases, weeds influx, seasonal changes, irrigation and postharvest losses all are accountable in lowering maize yield but among them the most important is tillage practices. Tillage itself can be defined as the physical, chemical or biological soil manipulation to optimize conditions for germination; seedling establishment suppresses weeds, control soil erosion, and preserves adequate soil moisture and crop growth (Zamir *et al*., 2013). Koller (2003) opined that tillage is a mechanical and manipulation action exerted on soil to modify soil conditions for nurturing crops. Selection of an appropriate tillage practice for crop production is very important for optimum crop growth and yield as opined by Memon *et al*. (2013). Proper tillage can lead to better spatial distribution of roots, improving the nutrient and water uptakes, hence improved productivity and weed control to positively influence the crop yield (Shafique *et al*.,2013; Singh and Malhi, 2006).

Tillage practices are critical components of soil management system and a good soil management program that protects the soil from water and wind erosion, provides a good weed free seedbed for planting, breaks hardpans that may limit root development and allows maintenance and even increase of organic matter content of the soils. However, Nigerian farmers employed different tillage practices in the production of the maize crop. Some farmers plant maize after disc ploughing without disc harrowing while some disc harrow without disc ploughing before planting, some “slash and burn”, while others use no tillage before planting maize. Others use disc plough and disc harrow before planting. Many of these farmers perform some of those tillage operations without being aware of the effect of these operations on soil physical properties and crop responses (Ozpinar and Isik, 2004). Whereas Rasmussen (1999) reported that tillage systems are site specific and depend on crop, soil type and the climate. Thus, different tillage practices may affect the growth and yield of crops due to different soil conditions created. Therefore, this research work aimed at investigating the influence of different tillage practices on soil properties under maize cultivation on Typic Plinthustalf Soil of southern guinea savanna zone of Nigeria.

MATERIALS AND METHODS

Experimental Site

The field experimental was conducted at the Teaching and Research Farm of Kwara State University, Malete, Nigeria on latitude 8^0 71’N and longitude $4^0$44’E at 385 m. a.s.l. The location is within guinea savannah agro-ecological zone of the country. The total land is approximately 1,400 hectares and is eight kilometers north of the University campus. The climate is characterized by distinct wet and dry seasons with a mean annual temperature that ranges from 25 to 28.9 ^{0}C. The annual mean rainfall is about 1,150 mm, exhibiting a double maximal pattern between April and October of every year. The wet season is between April and October while dry season starts November and ends in April.

Experimental Design

Each plot size was 5 x 11m in dimension. The treatments which are three different tillage practices (No-till, Single plough and Plough + harrow) and maize crop were then randomly arranged in each replicate with three plots. Experimental design was a 3 x 11 factorial experiment fitted into randomized complete block (RCBD). The maize crop was 10 quality protein maize varieties sourced from International Institute of Tropical Agriculture (IITA) and a local check.

Soil Sampling and Analysis

During land preparation and after harvesting, soil samples were randomly collected from different spots in the experimental site in each plot at depth of 0-15 cm and 15-30 cm with soil auger. The samples were bulked to form a composite sample from which a representative sample was air-dried and crushed. Soil samples were sieved through 2 mm for physical and chemical analysis. Soil profile was equally dug for soil classification. Core samples were taken to determine soil bulk density, saturated hydraulic conductivity and permeability. Bulk density (core method) was estimated by dividing the oven dry mass of the soil at 105 ^{0}C by the volume of the soil as:

$$Pb = Ms/Vb$$

Where Pb is the bulk density, M_s is oven dry mass of the soil and V_b is the volume of soil in the core, total porosity was estimated as

$$TP = (1\text{-}pb/ps) \times 100$$

Where pb is the bulk density and ps is the particle density given as 2.65 gcm^{-3}. Particle size analysis was determined using Bouyoucous Procedure. Soil textual triangle as described in Soil Survey Staff (2014) was used to determine soil textural class.

Saturated hydraulic conductivity (K_Q) was determined by maintaining constant head method above undisturbed core (Oshunsanya, 2013). A flask of water was inverted above the core containing water in order to maintain constant head of water. The quantity of water (Q) drained in every 5 minutes was measured until equilibrium (constant flow of water) was reached. Permeability was calculated from saturated hydraulic conductivity as follows:

$$Ks = K_Q \int / e_w g$$

Where: Ks = Permeability (cm^2); Cw = Density of water (1 g/cm^3); g - Acceleration due to gravity (980 cm/sec); I = Viscosity at 27 ^{0}C (0.00855 g/cm/sec); K_Q = Saturated hydraulic conductivity (cm/sec) Soil chemical parameters determined are:

Soil pH: 10 mls of water was added to 10 g of air dry soil weight (1:1) and stirred inside the plastic bottle with the aid of glass rod. Electrode pH meter was then inserted to read the soil pH in water. Organic carbon (C) was determined using Walkley Black method. Total nitrogen (N) was determined using Macro Kjedahl Method that involves digestion, distillation, condensation and titration (Okalebo *et al*., 1993). Phosphorous (P) was determined using Mehlich III multipurpose extractant and Atomic Adsorption spectrometer machine was used to read the value. Potassium (K) was determined using flame photometer as well as extractable micronutrient (mg/kg) and exchangeable bases (cmol/kg) (Okalebo *et al*., 1993).

Cultural Practices

The maize crop was sown at two seeds per stand with planting distance of 60 x 60 cm. It was later thinned to one plant per stand at two weeks after planting. Weeding was manually done at six weeks after sowing while there was no pest and diseases infestation. Fertilizer application was done at 3 weeks and 6 weeks after sowing at the recommended rate of 60 kg Nitrogen (N), 30 kg Phosphorus (P_2O_5) and 30 kg Potassium (K_2O) (60:30:30 (NPK)}as first dose and urea 45 kgN was used as second dose. The fertilizer was applied on drill lines about 5-7 cm away from the plant.

Data Collection and Analysis

Data collected on maize crop were plant height, number of leaves, days to 50 % anthesis, pollen and silking which observed on the field based on the plant population per plot.

Data collected were subjected to analysis of varianve (ANOVA). Where significant difeerence exist, treatment means were separated using Duncan's Multiple Range Test (DMRT) at 5% probability level.

RESULTS AND DISCUSSION

The results of physical and chemical properties of the soil of the experimental site were as presented in Table 1. The soil pH ranges from 5.88 - 6.17 indicating a moderately acidic soil. The Total exchangeable acidity ranges from 0.15 - 0.20 cmol/kg. Percentage total Nitrogen and organic carbon contents fluctuate with profile depth and range from 0.14 - 0.24 % and 1.27 - 2.29 % respectively. The available phosphorus and CEC fluctuate down the profile (ranging from 1.28 - 5.96 mg kg^{-1} and 3.79 - 5.93 cmol kg^{-1}, respectively). The percentage base saturation of the soils was consistently higher than 90 % (ranges from 94.7 - 97.5 %). The bulk density ranges from 1.52 – 1.67 g/cm^3 which vary down the profile as well as the total porosity which ranges from 37 – 43 %. This is in line with the findings of Golchin *et al*., (1995) that the bulk density of a desirable agricultural sandy soil ranges from 1.5 – 1.7 g/cm^3 while their total porosity ranges from 36 – 43 %. The permeability decreased down the profile (1.51 – 5.97 cm hr^{-1}). The sand particles decreased down the profile (706 – 846 g kg^{-1}) while the clay and silt differs down the profile (60 – 140 g kg^{-1} and 94 – 154 g kg^{-1} respectively). The soil texture for 0 - 61cm depth is loamy sand while from 61 cm to parent material is sandy loam. Generally, the soil was well drained at the time of sampling, but few, distinct dark reddish grey mottles (10 R 3/4) were observed at a depth of 35 – 86 cm. With increase in depth, the mottles became many, coarse and prominent with a colour change from dark reddish grey to black (5 YR 2/1) at a depth 86 -147cm. The mottling observed in the soils may be attributed to the reducing condition of iron in the soil due to alternating wetting and drying conditions over a long period of time (Eswaram *et al.*, 2003). The pedon had medium sub angular blocky structure in both surface and sub-surface soils.

The profile had a consistency that ranged from friable, loose, slightly- sticky, to slightly plastic (wet). The boundaries between the horizons were gradual and smooth throughout the pedon. The soil was classified as Typic Plinthustalf because it has an ustic moisture regime, it is an Alfisol and the percentage cation exchange capacity is greater than

35 % in the sub soil with Typic Plinthite soils. It contains kandic horizon at the surface profile while at the sub-surface area it contains an Argillic horizon.

The pre-planting chemical and physical properties of the soil surface for the experimental site at 0 – 15 cm and 15 – 30 cm depth reflected that the hydraulic condition and bulk density increased with depth (ranges from 5.14 – 5.73 cm/hr and 1.65 – 1.66 g/cm^3) while porosity was between 37 – 38 % (Table 2). The pH ranges from 6.31 – 6.50. The TEA and CEC varied with depth which ranges from 0.11 – 0.14 cmol/kg and 6.02 – 7.54 cmol/kg respectively. The total nitrogen varied between 0.15 – 0.20 g/kg while the available phosphorus ranges from 2.20 – 2.80 mg kg^{-1}.

The K, Na and Ca decreased down the depth (ranges from 0.54 – 0.60, 0.30 – 0.33 and 1.13 – 2.92) while Mg was 0.80 in the two depth. This indicate that the soil macro and micro nutrients were inadequate thus the need for fertilization for effective crop growth (Zamir *et al*., 2013). The percentage base saturation varied between 96.1 % – 97.5 %. The sand and clay content ranges from 819 – 826 g/kg and 60 – 67 g/kg which decrease down the depth while the silt content fluctuated down the depth (range from 107 – 121 g/kg). The permeability ranges from 5.14 – 5.73 cm/hr while the soil texture in the two depths is loamy sand.

Table 3 shows the physical and chemical properties of the soil sample of the studied site under no-tillage. The bulk density varies down the profile as well as total porosity increased (ranges 1.63-1.71 g/kg and 44% - 49 % respectively) which indicate that the soil in that environment is suitable for agricultural use (Golchin *et al*., 1995). The soil pH ranges between 5.85 and 6.04 which indicated slightly moderate soil that is desirable for maize cultivation because it can tolerate soils with a pH of 5.0 - 7.0 but a moderately acidic to neutral environment of pH 6.0 - 7.0 is optimum (Jamieson *et al*., 1995). The total exchangeable acidity, %OC, CEC and total nitrogen fluctuated down the depth (ranged from 0.17 - 0.31 cmol/kg, 1.01 - 1.58 %, 4.62 - 5.14 cmol/Kg and 0.09 - 0.11 % respectively). The sand and clay decrease down the profile which ranges between 805 – 818 g/kg and 80 – 84 g/kg while silt increases down the depth 88 – 105 g/kg. The K, Na and available phosphorus decreased down the profile (0.42 - 0.50, 0.23 - 0.28 and 1.55 - 1.67 respectively). The texture of the profile is loamy sand while the % BS ranges from 93.1 - 94.5 % and the permeability increased down the profile which ranges from 4.34 - 4.50 cm/hr site under single plough.

Table 4 shows the physical and chemical properties of the soil sample of the studied site under single plough. Total exchangeable acidity and cation exchangeable capacity decreased down the profile (range 0.21 - 0.54 cmol/kg and 7.32-8.84 cmol/kg). The %OC and the TN decreased down the profile (1.61 - 2.18 % and 0.13 - 0.22 g/kg). The sand contents decreased down the profile which ranges from 858 – 892 g/kg while the clay and silt increased down the profile (41 – 64 g/kg and 67 – 78 g/kg respectively). The pH of the soil ranges from 6.00 - 6.34 which is still slightly acidic and the total porosity increase down the profile (39-42 %). Bulk density decreases down the profile (1.48 - 1.56 g/cm^3) the same as available phosphorus (1.49 - 1.77 cmol/kg).

The K, Na, Mg and Ca declined down the profile (0.51 - 0.66 cmol/kg, 0.20 - 0.39 cmol/kg, 1.47 - 1.94 cmol/kg and 2.33 - 3.02 cmol/kg respectively). %BS falls down the profile which ranges from 92 – 96 % while the permeability rises down the profile (range 5.04 - 5.53 cm/hr).

Table 5 shows the physical and chemical properties of the surface soil of the studied site under plough+harrow. The %BS was consistently higher than 90 % which ranged from 96.1 - 97.5 %. The bulk density decreased down the depth (ranged from 1.62 - 1.58 g/cm^3)

while the total porosity increases down the profile (41 – 46 %). The pH of the soil ranged from 5.85 - 6.44 which is moderately acid and total exchangeable acidity decrease down the depth (0.64 - 0.28 cmol/kg). Sand and clay decreased down the depth (846 – 809 g/kg and 87 – 71g/kg respectively) while silt increased down the depth, ranged from 97 – 110 g/kg. The K, Na, Mg and Ca, all decreased down the depth (ranged from 0.74 - 0.53 cmol/kg, 0.48 - 0.29 cmol/kg, 2.37 - 1.87 cmol/kg and 3.72 - 2.63 cmol/kg respectively). The soil texture is loamy sand and the permeability increased down the depth, ranged from 5.14 - 5.73 cm/hr.

The porosity and permeability characteristics of the surface soil under plough+harrow after maize cultivation increased down the depth. However, other parameters considered decreased with depth increases. The %BS was consistently higher than 90 % (96.1 - 97.5 %). The soil texture class of the surface soil remains Loamy sand and the same for the rest of the treatment imposed.

Generally, the level of macro and micro-nutrient observed in all the tillage practices imposed before planting and after planting was low according to FFDN (2002) recommendation. This further indicated the need for effective management that will be sustainable. However, the level of the nutrients surface soil of the studied site under single plough (Table 4) and that of the surface soil of the studied site under No-till (Table 5) was higher than that of the surface soil of the studied site under No-till. The higher % OC observed on single plough and plough and harrow field indicates the importance of the tillage practices that encourage build-up of organic matter through buried plant residue as result of increased microbial activities within the soils.

Table 6 shows the effect of tillage practices on days to 50% anthesis, silking and pollen of quality protein maize varieties. The result shows significant difference across Tillage practices. The earliness to 50% anthesis (54 days), silking (65 days) and pollen (68 days) was observed in the plough+harrow and single plough plots. The trend of the earliness to 50% anthesis, silking and pollen was plough+harrow = plough > No tillage. The range of days to 50% anthesis was 52 – 57days (PVA SYN 10 F2 - TZE QI 25) while that of 50% silking was 64 – 67days (PVA SYN 11 F2 – TZE QI 27) and pollen 68 – 70days (PVA SYN 11 F2 – TZE QI 20).

The effect of tillage practices on plant height and number of leaves plant height and number of leaves of quality protein maize varieties is presented in figures 1 and 2. The results shows that tillage practices significantly influenced the performance of the quality protein maize. The tallest plant height was observed in the plough+harrow plots (400cm) at 10th weeks after planting while the shortest plant was observed in No tillage plots. Similar trend was also observed in the number of leaves of quality protein maize with the highest number leaves recorded at the same 10th weeks after planting (14) (Figure 2). The trend of plant height as observed in figure 1 is plough+harrow > plough > No tillage.

Table 1: Physical and chemical properties of the soil from the profile of studied site

											(cmol/Kg)							
Depth (cm)	Bulk density (g/cm^3)	Porosity (%)	pH (H_2O)	TEA (cmol/Kg)	CEC (cmol/Kg)	% OC	% TN	Sand (g/Kg)	Clay (g/Kg)	Silt (g/Kg)	$K^=$	Na	Ava. P	Mg	Ca	Texture	% BS	Permeability (cm/hr)
Gzambari series		TypicPlinthustalf																
0 – 21	1.67	37	6.17	0.15	5.93	2.29	0.24	846	60	94	0.54	0.33	5.11	0.99	3.92	LS	97.5	5.97
21 – 41	1.62	39	6.11	0.15	3.81	1.92	0.20	826	80	94	0.43	0.26	5.96	0.74	2.23	LS	96.1	4.12
41 – 61	1.62	39	5.88	0.20	5.55	1.35	0.14	786	80	134	0.76	0.29	1.28	0.66	3.64	LS	96.4	3.95
61 – 156	1.52	43	6.08	0.20	3.79	1.27	0.14	706	140	154	0.42	0.31	1.42	0.57	2.29	SL	94.7	1.51

pH = soil acidity; TEA = Total exchangeable acidity; CEC = cation exchangeable capacity; OC% = percentage Organic Carbon; %TN = Total Nitrogen; BS = Base saturation; LS = loamy sand; SL = sandy loam

Table 2: Pre-planting chemical and physical properties of soil samples used for the experiment

					(cmol/Kg)							(cmol/Kg)							
Depth (cm)	Hydraulic cond. (cm/hr)	Bulk density (g/cm^3)	Porosity (%)	pH (H_2O)	TEA	CEC	% OC	TN (g/Kg)	Sand (g/Kg)	Clay (g/Kg)	Silt (g/Kg)	$K^=$	Na	Ava. P	Mg	Ca	Texture	% BS	Permeability (cm/hr)
0 – 15	5.14	1.65	38	6.50	0.14	7.54	1.90	0.20	826	67	107	0.60	0.33	2.20	0.80	2.92	LS	97.5	5.14
15 – 30	5.73	1.66	37	6.31	0.11	6.02	1.41	0.15	819	60	121	0.54	0.30	2.80	0.80	1.13	LS	96.1	5.73

pH = soil acidity; TEA = Total exchangeable acidity; CEC = cation exchangeable capacity; OC% = percentage Organic Carbon; %TN = Total Nitrogen; BS = Base saturation; LS = loamy sand

Table 3: Physical and chemical properties of the soil sample of the studied site under no-till

Depth (cm)	Bulk density (g/cm^3)	Porosity (%)	pH (H_2O)	TEA (cmol/Kg)	CEC (cmol/Kg)	% OC	TN (g/Kg)	Sand (g/Kg)	Clay (g/Kg)	Silt (g/Kg)	K$^=$ (cmol/Kg)	Na (cmol/Kg)	Ava. P (cmol/Kg)	Mg (cmol/Kg)	Ca (cmol/Kg)	Texture	% BS	Permeability (cm/hr)
0 – 15	1.71	44	6.04	0.31	5.14	1.58	0.11	818	84	88	0.50	0.28	1.67	1.30	3.15	LS	94.5	4.34
15 – 30	1.63	49	5.85	0.17	4.62	1.01	0.09	805	80	105	0.42	0.23	1.55	1.67	2.35	LS	93.1	4.50

pH = soil acidity; TEA = Total exchangeable acidity; CEC = cation exchangeable capacity; OC% = percentage Organic Carbon; %TN = Total Nitrogen; BS = Base saturation; LS = loamy sand

Table 4: Physical and Chemical properties of the soil sample of the studied site under single plough

Depth (cm)	Bulk density (g/cm^3)	Porosity (%)	pH (H_2O)	TEA (cmol/Kg)	CEC(cmol/Kg)	% OC	TN (g/Kg)	Sand (g/Kg)	Clay (g/Kg)	Silt (g/Kg)	K$^=$ (cmol/Kg)	Na (cmol/Kg)	Ava. P (cmol/Kg)	Mg (cmol/Kg)	Ca (cmol/Kg)	Texture	% BS	Permeability (cm/hr)
0 – 15	1.56	39	6.34	0.54	8.84	2.18	0.22	892	41	67	0.66	0.39	1.77	1.94	3.02	LS	97.2	5.04
15 – 30	1.48	42	6.00	0.21	7.32	1.61	0.13	858	64	78	0.51	0.20	1.49	1.47	2.33	LS	96.0	5.53

pH = soil acidity; TEA = Total exchangeable acidity; CEC = cation exchangeable capacity; OC% = percentage Organic Carbon; %TN = Total Nitrogen; BS = Base saturation; LS = loamy sand

Table 5: Physical and Chemical properties of the soil sample of the studied site under plough+harrow

Depth (cm)	Bulk density (g/cm^3)	Porosity (%)	pH (H_2O)	TEA (cmol/Kg)	CEC (cmol/Kg)	% OC	TN (g/Kg)	Sand (g/Kg)	Clay (g/Kg)	Silt (g/Kg)	$K^=$ (cmol/Kg)	Na (cmol/Kg)	Ava. P (cmol/Kg)	Mg (cmol/Kg)	Ca (cmol/Kg)	Texture	% BS	Permeability (cm/hr)
0 –15	1.62	41	6.44	0.64	7.54	2.48	0.30	846	87	97	0.74	0.48	1.97	2.37	3.72	LS	97.5	5.14
15–30	1.58	46	5.85	0.28	6.02	1.19	0.19	809	71	110	0.53	0.29	1.65	1.87	2.63	LS	96.1	5.73

pH = soil acidity; TEA = Total exchangeable acidity; CEC = cation exchangeable capacity; OC% = percentage Organic Carbon; %TN = Total Nitrogen; BS = Base saturation; LS = loamy sand

Table 6: Effect of tillage practices on days to 50% Anthesis, Silking and Pollen of quality protein maize varieties

	Days of 50% Anthesis	Days of 50% Silking	Days of 50% Pollen
TILLAGE			
No tillage	56.73	67.47	71.23
Plough	53.73	64.47	68.23
Plough + Harrow	53.73	64.47	68.23
lsd = 0.05	1.45	0.94	0.87
PVA SYN 11 F_2	54.67abc	64.33c	68.00b
PVA SYN 1 F_2	57.33a	66.00abc	69.00ab
PVA SYN 19 F_2	56.33ab	65.67abc	69.33ab
PVA SYN 10 F_2	52.33c	64.67bc	68.67ab
PVA SYN 17 F_2	56.33ab	66.33ab	69.33ab
PVA SYN 9 F_2	55.67ab	64.67bc	69.67ab
TZE QI 25	52.33c	66.00abc	69.67ab
TZE QI 34	54.33abc	65.33abc	69.33ab
TZE QI 27	54.67abc	66.67a	69.33ab
TZE QI 20	53.33bc	65.00abc	70.00a
lsd = 0.05	0.79	0.38	0.47
T X C	NS	NS	NS

T X C = Tillage by crop interaction; Means with the same alphabets under crop factors are not significantly different from each other at p>0.05

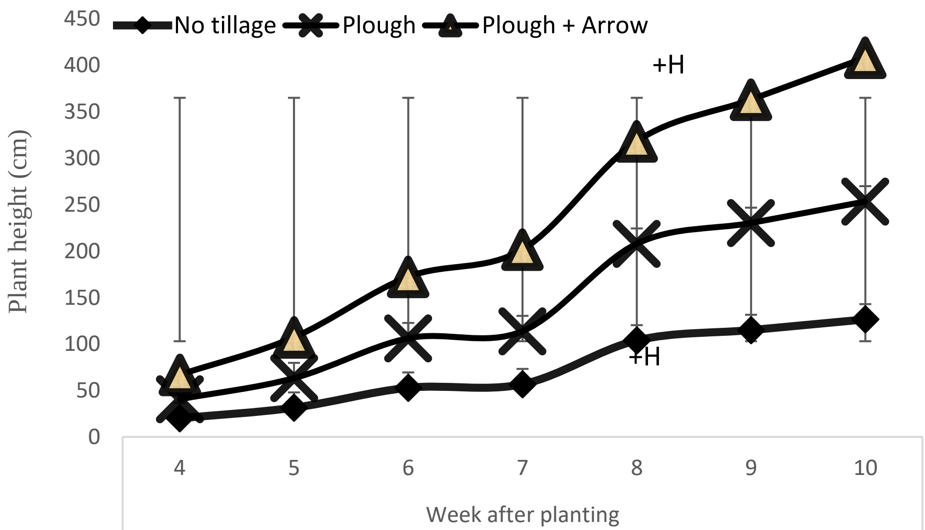

Figure 1: Effect of Tillage practices on ten quality protein maize plant height

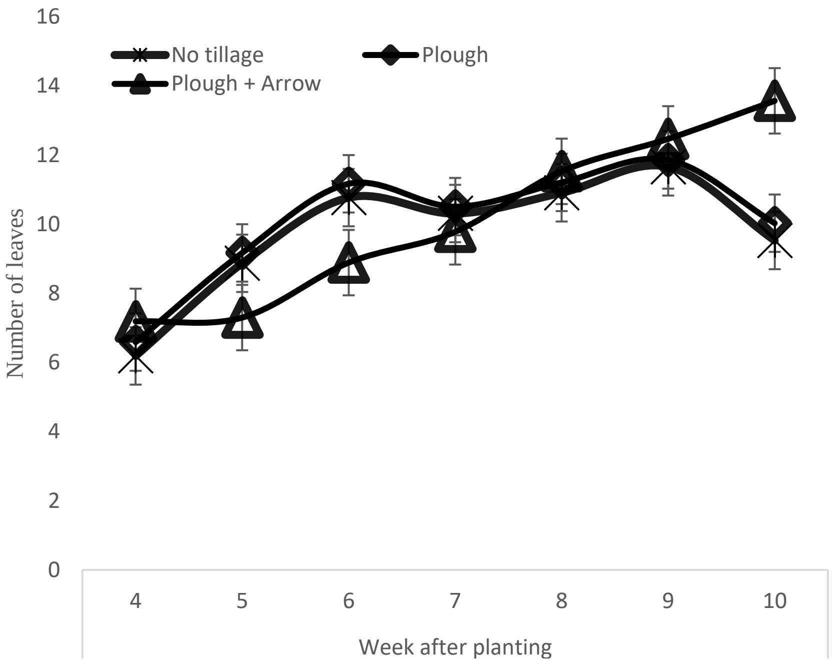

Figure 2: Effect of Tillage practices on quality protein maize number of leaves

CONCLUSION

Findings of the study revealed that the soil inherent capacity indicators such as texture, permeability and bulk density of the study area indicated a suitable agricultural soil despite the tillage activities. The trend observed ranged in the order of plough+harrow >plough>No till. However, the variability in soil dynamic properties such as CEC, pH, OC macro and micro nutrients was in the order of No till>plough>plough+harrow. This study indicated that the soil dynamic physical and chemical properties of the surface soil of the studied site under no-tillage were greatly influenced by the cropping activities thereby resulting to low nutrient status.

In addition, considering the result obtained from this study, it can be concluded that tillage practices influenced soil properties of Typic Plinthustalf soil of Guinea Savannah under maize cultivation. Thus, tillage practices that center on Plough and Harrow can successfully promote sustainable management of Typic Plinthustalf soil of Guinea Savannah under maize cultivation.

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