Innovations

Assessment of Infiltration Pattern of Granular Soil Under Different Crops Cover Types in Akpabuyo, Southeastern Nigeria

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Abstract: *Understanding infiltration characteristics of soil is crucial for effective soil management and sustainable crop production process in sandy soil environment. The purpose of the study was to examine the influence of crop cover types on infiltration pattern of granular soil. Soil samples were collected for laboratory determination of textural properties while infiltration pattern was determined with double ring infiltrometer for cumulative time of 180 minutes. Results of soil physical properties showed that they have monolithic textural characteristics with mean values of 76, 73, 75, 69 per cents sand; 11, 15, 11, 20, silt; 13, 8, 12, 11, clayfor cassava, maize, plantain and oil palm plots respectively. Results of cumulative intake of various ground cover types ranged between 0 - 44.50 (plantain), 0 - 43.20 (oil palm), 0 - 48.00 (cassava) and 0 - 46 (maize). Results showed that different crop cover types influence infiltration pattern differently. Similarly, longer growth cycle of crops (plantain and oil palm plots) results in the production of litter falls/residues that influence inflow of water into the soil. The study recommends crops that promote the production of residues that have water holding capacity as well as interfere with excess water infiltration in granular soils.*

Keywords: Infiltration pattern, granular soil, water percolation, crops cover types, double ring infiltrometer, soil texture.

1. Introduction

Soil infiltration is a product of an interaction between water, soil and its associated variables which do not work in isolation to determine the rate of water in-flow into the soil. In-flow of water into the soil is a critical factor in the holistic performance of soil from weathering to maturation.The characteristic of soil determines the infiltration or in-flow of water into the soil and consequently influences the use of land (soil) for sundry human activities. Land use type is no doubt capable of influencing infiltration rate and pattern of water in-flow in view of the impact it poses on the top soil where most of the activities are based. Infiltration pattern represents a pathway or direction of in-flow of water into the soil. The spatial and temporal patterns of infiltration were investigated [1]. There is no doubt that infiltration patterns may be necessitated by a number of factors including crops cover types which directly influence the volume of litter falls and consequent soil microbial activities. Soil micro and macro organisms including soil improvement materials (mulching, decomposed organic materials) and litter fall from trees provide the ambiance with which infiltration process is facilitated.Zhang et al [2] examined the effect of organic and inorganic fertilizer in the soil and found that they influence organic carbon and enzymatic activities in the soil whileYue et al [3] posited that organic matter content in the soil is capable of impacting the physical and mechanical properties of soil which in turn influence water percolation in the soil.Nkwopara et al [4] examined the loss of soil fertility and attributed it to inherent nature of tropical soilwhich may be worsened by excess infiltration.Crops production exerts some important contribution to soil water dynamics; water enhances uptake of plant nutrients for its growth processes, conversely, their litter falls produce residues that help to store soil water that contribute to the determination of soil water status.Daryanto et al [5] examined ecosystem service of cover crops while Guo et al [6] and Hellwinckel and Philips [7] considered the carbon stock advantage of land use cover change. Meanwhile, Peng et al,[8] attributed changes in water percolation and hydrologic characteristics of soil to vegetation cover type.Hulugalle and Ndi [9] emphasized the use of alley cropping in improving water infiltration in the soil. Association of micro-fauna such as earthworms, termites, crickets turn the soil, providing channels that increase absorption rate of water into soil as well as improves soil fertility.

Infiltration rate of soil expresses inherent characteristics of such soil in its natural condition when water is allowed to pass through it. Precipitations, irrigation, in-flows from oceans during high tides are some of the channels through which water passed through or into the soil. Ground water retained in the surrounding soils may infiltrate into the soil through broken pipes, poor joints and sewer structures. Rattan et al, [10] and Chhonkar et al [11] posited that precipitation, on-farm irrigation and other means underpinning water in-flow aim to aid uptake of nutrient by plants. [12] remarked that this water is needed to replenish soil moisture deficiency; deficiency may result from evaporation, absorption by plant for metabolic processes, direct seepage and human activities. Human-induced disturbances have profound influence on water infiltration, and are capable of undermining land productivity [13, 14, 15, 16]. For instance, during large scale agronomic operations, the use of heavy equipments are usually employed in the place of human labour while in small scale agriculture, bush burning is an inevitable part of crop production process mostly in the context of rural communities. Unfortunately, these activities have spatio-temporal influence on soil biophysical factors.Daniel et al [17]examined spatial pattern of infiltration while [18] proved that infiltration rate is greater during the dry season for site planted with Leucaena and Gliricidia than site without trees.

The essence of infiltration is not only to assess the amount of water that enters into the soil, but the entrainment of chemicals such as nutrients, required for plant growth and development including those of pollutants that dissolved in the soil. Masto et al [19] stressed on change of soil quality in view of nutrient enrichment. This implies that soils with good infiltration characteristics can adequately ensure availability of water and soil nutrients for plant growth as well as retain nutrients that dissolved in the soil by reducing run-off and flooding. Conversely, excess water in the soil can reduce the quality of nutrients and exacerbate pollution effect thereby interfering with plant health. Infiltration related problem may be misconstrued for lack of plant nutrient and may lead to unguided use of agrochemical to enhance plant growth [20, 21]. The use of organic fertilizer to remedy such situation was emphasized by [22, 23].

Land cover type in the infiltration process and the understanding of water infiltration of soil has important contributions in the determination of soil physical characteristics; soil texture, structure, consistence bulk density. Water infiltration has important impact in the functioning of agro ecological landscape. It predicts soil performance through literal assessment of flow velocity; thus, increased infiltration rate is linked to soil texture and structure, soil with such characteristics will allow water percolate through it and reduce surface run-off and consequently decrease soil erosion. The more water percolates the soil the more it increases the hydrological re-charge and enhances water availability for plant growth. However, optimal or moderate infiltration is desirable to drive crop production as well as underpins environmental sustainability, biodiversity stability and insusceptibility of soil to adverse environmental condition [24].

Demographic pressure is associated withland use change and misuse of land resources [25]. Assessment of infiltration rate is an important prerequisite in agro-ecological landscape [26]as it leads to a coordinated food production practice and ensure proper use of land to address demographic challenges. Loose textural characteristics tantamount to inability of soil to hold water consequently allowing water pass through it uncontrollably. On the other hand, soils with compacted aggregates tend to reduce passage of water into it thus, encouraging runoff and erosion perturbations.[27], examined the relationship between infiltration and land use cover type and found that land use determine soil water infiltration to a large extent.

Vegetation covers have the ability to prevent direct impact of rain drop on the soil surface thereby disallowing water movement through the soil arbitrarily. Egbai et al [28] averred that, Plants physiological features; leaves, stems and root systems are responsible for important ecological functions, maintaining that crops' cover with thicker leafy parts produce and enrich the soil with residues that in turn influence infiltration rate. Similarly, large plant trunk (stem)produces profuse leaves branches and root systems that interfere with rain drop, water percolation, runoff and erosion [9]. Assessing infiltration rate of various vegetation covers is an important prerequisite in agro-ecological landscape[26]as it could lead to efficient utilization of land for food production purposes based on the knowledge of water-soil relationship of various vegetation cover requirements. In recent times, it has become increasingly difficult to identify the main cause of dwindling crop production with particular reference to annual crops on one hand and to identify crop types that will suit granular soil condition of the study area. It is unarguable, granular soils are largely susceptible to excess infiltration which has been copiously addressed by a number of researchers including Eze et al [29] who carried out an evaluation of infiltration capacity of Akpabuyo and found that the area is highly vulnerable to excessive infiltration.This study focuses on the assessment of infiltration pattern of granular soils under a variety of crops cover types. The importance of this study cannot be over emphasized, in view of the dominant role of agriculture as a dependable source of economic livelihood of the people; therefore, the knowledge of infiltration pattern of various crops cover types can no doubt engender focus driven food production practice in Akpabuyo and in areas with similar soil characteristics.

2. Study Area

The study was conducted in the coastal plain soils of Akpabuyo, Southeastern Nigeria. This area is marked with relatively small elevations that ranged between 250 to 350m. Slope direction is generally southern. It lies between longitude 8^0 25 and 8^0 40'E of the Greenwich meridian and latitude 4^0 45' and 5^0 40'N of the equator. This area falls within the Atlantic coastal line of Nigeria, with a tropical humid climatic condition, controlled by two air masses, the dry continental air mass and the humid maritime air mass which is responsible for rainfall in the area [30]. The annual rainfall varies between 3500 mm – 4000 mm while the geology comprises tertiary sandy deposits of Fluvio-Marin origin which are overlain by quaternary silt and clayey alluvial soil materials, eroded from Oban Hills in the outskirts. These characteristics of poorly consolidated none cohesive and porous rock formation permit large accumulation of ground water with slight variation in rainfall regime. The annual average rainfall is about 2000 mm [31]. Temperature rarely falls below 19^0C and an average of 27^0C throughout the year. The relative humidity is usually between 80-100 percent and a vapour pressure averages 25 mbars. Food crop production has remained the most dominant occupation of the people. Crops such as cassava, maize, yam, cocoyam, potatoes, pumpkin, waterleaf, oil palm and lots more are generally cultivated by the local farmers as a means of economic livelihoods.

3. Materials and method

The study was carried out during the crops growing season of 2022 on existing farmlands and repeated in each of the ground cover types. The repetition was to affirm the trend and pattern of infiltration across the experimental plots as well as forestall biases as all plots were established on similar topographic condition. Land area of 2x5m was delineated on each ground cover type for the purpose of establishing infiltrometer. However, no agronomic practices such as land clearing, weeding, and others were involved except skeletal trimming down of vegetative outgrowth of specific location where infiltromiter was mounted. Infiltration rate was determined with the use of double ring infiltrometer with dimension of 50cm and 30cm diameters respectively. These were driven into the soil to the depth of 10cm using sledge hammer to avoid lateral flow of water. Water was poured simultaneously into the two rings (inner and outer) up to 10cm. the inclusion of the outer ring was done to facilitate downward movement of water in the inner ring and to maintain hydrostatic equilibrium. Although, the water was released in the form of 'waterfall' but care was taken to ensure that soil structure was not implicated [31, 32].

Records of infiltration rate were obtained at 5, 10, 15 and 30 minutes intervals using electronic timer for 180 minutes Philip [32] advised that, the process must continue until a steady state is reached where water ceases to penetrate and the water level in the ring remains at the same level without further downward movement. The experiment was repeated after one month under the same Vegetation cover types viz: cassava, maize, plantain and oil palm plantation. Mean result of infiltration records were obtained as contained in tables (5-8) as well as in figures (1-4). The idea behind the use of various crops cover types was to examine the pattern of soil water infiltration of the respective cover types. Soil samples were collected randomly from each site with an auger at the depth of 0-30cm for laboratory determination of their particulate size distribution prior to the investigation.

4. Result And Discussion

Results of soil textual characteristics (soil particle distributions of sand, silt and clay) are shown in tables 1-4. similarly, infiltration records from the respective crops cover types shown in tables 5-8.

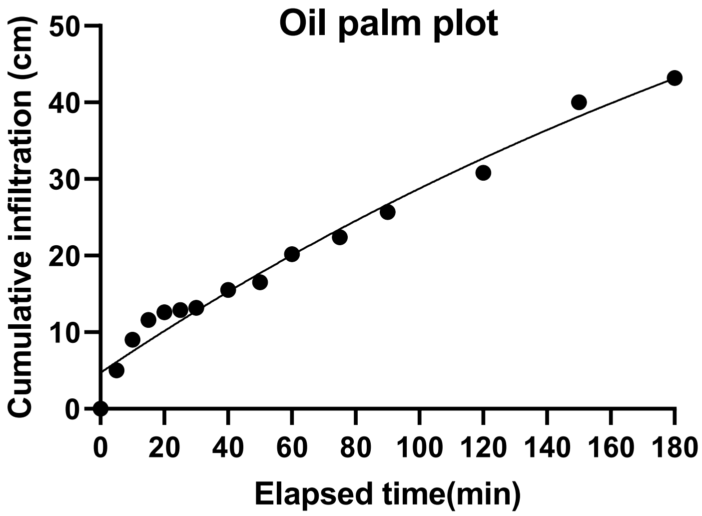

Fig 2b: showing cumulative intake and time in oil Table 1: soil physical characteristics of cassava plot.

S/N	Sample points	Sand	Silt	Clay	Texture
1	I	75	12.0	13.0	SL
2	II	77	12.0	11.0	SL
3	III	74	11.0	15.0	SL
4	IV	78	10.0	12.0	SL
5	V	77	11,0	12.0	SL
RANGE		74-78	10-12	11-15	
MEAN		76	11	13	

SL: Sandy loam

Table 2: Soil physical characteristics of maize plot.

S/N	Sample points	Sand	Silt	Clay	Texture
1	I	72	13.0	17.0	SL
2	II	77	13.0	10.0	SL
3	III	69	14.0	17.0	SL
4	IV	78	12.0	10.0	SL
5	V	68	18.0	140	SL
RANGE		68-78	12-18	10-17	
MEAN		73	15	8	

SL: Sandy loam

Table 3: Soil physical characteristics of Plantain plot.

S/N	Sample points	Sand	Silt	Clay	Texture
1	I	72	12.0	16.0	SL
2	II	76	9.0	15.0	SL
3	III	78	12.0	9.0	SL
4	IV	77	13.0	10.0	SL
5	V	75	14.0	11.0	SL
RANGE		72-78	9-14	9-15	
MEAN		75	11.0	12.0	

SL: Sandy loam

Table 4: Soil Physical Characteristics of oil palm plantation.

S/N	Sample points	Sand	Silt	Clay	Texture
1	I	66	20	14	SL
2	II	68	24	8	SL
3	III	72	16	12	SL
4	IV	68	20	12	SL
5	V	68	24	8	SL
RANGE		66-72	16-24	8-14	
MEAN		69	20	11	

SL: Sandy loam

Table 5 infiltration rate of plantain plot

Time interval (minutes)	0	5	5	5	5	5	5	10	10	10	15	15	30	30	30
Cumulative time (minutes)	0	5	10	15	20	25	30	40	50	60	75	90	120	150	180
Cumulative intake (cm)	0	5.00	9.00	10.60	12.40	13.80	16.00	20.40	24.00	25.00	28.10	30.00	34.00	39.00	44.50
Infiltration rate (intake/time) cm/minute	0	1.00	0.90	.70	62	0.55	0.53	0.51	0.48	0.43	0.37	0.33	0.28	0.26	0.25
Infiltration rate in 60 minutes (cm/h)	0.	60.00	54.00	42.0	37.20	38.00	31.8	30.60	28.80	25.8	22.20	19.80	16.80	15.6	15.00

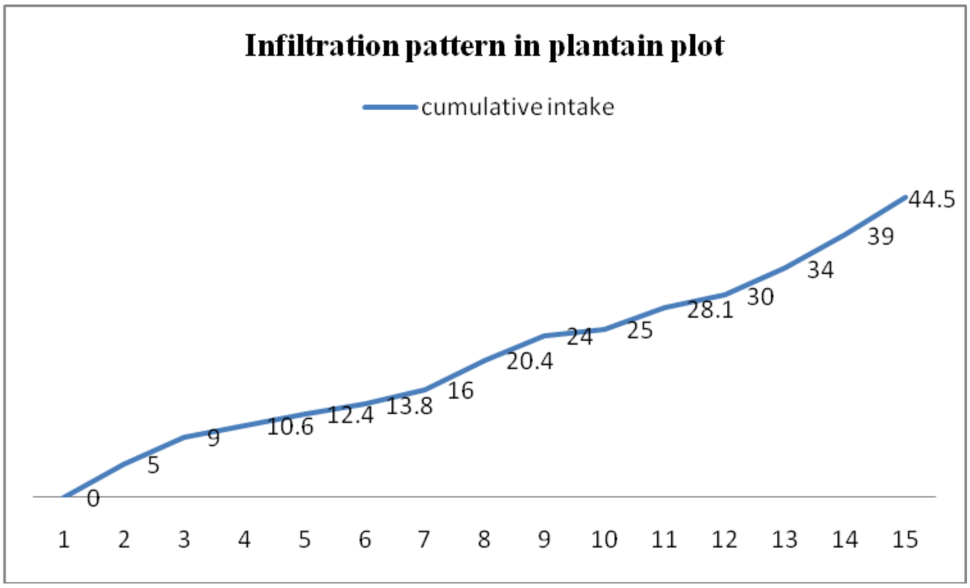

Fig 1: showing the pattern of infiltration in plantain plot

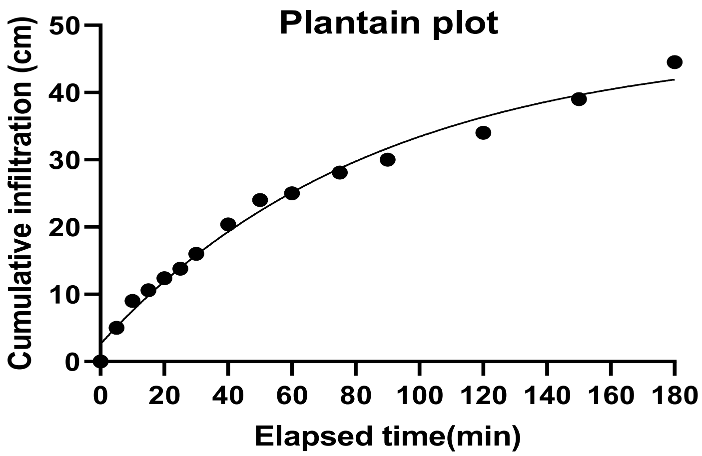

Fig 1b: showing cumulative intake and time in plantain plot

Table 6 infiltration rate in oil palm plot

Time interval (minutes)	0	5	5	5	5	5	5	10	10	10	15	15	30	30	30
Cumulative time (minutes)	0	5	10	15	20	25	30	40	50	60	75	90	120	150	180
Cumulative intake (cm)	0	5	9	11.60	12.60	12.90	13.20	15.50	16.5	20.20	22.40	25.70	30.8	40.	43.2
Infiltration rate (cm/minute)	0	1.00	0.90	0.73	0.63	0.52	0.44	0.39	0.33	0.33	0.30	0.29	0.26	0.26	0.24
Infiltration rate (cm/h)	0	60.00	54.00	46.80	37.80	31.20	26.40	23.40	19.80	19.80	18.00	17.40	15.00	15.00	14.00

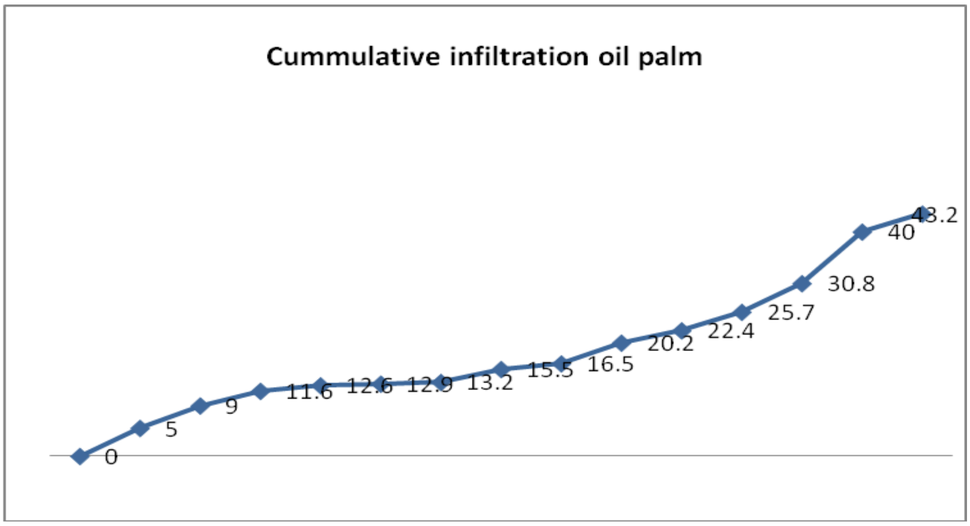

Fig 2: showing infiltration pattern in the oil palm plot

Table 7 infiltration rate in cassava plot

Time interval (minutes)	0	5	5	5	5	5	5	10	10	10	15	15	30	30	30
Cumulative time (minutes)	0	5	10	15	20	25	30	40	50	60	75	90	120	150	180
Cumulative intake (cm)	0	5	10	10	10	10	15	16	18	28	30	38	42	45	48
Infiltration rate (cm/minute)	0	1.00	1.00	0.66	0.50	0.40	0.500	4.00	0.36	0.46	0.40	0.42	0.35	0.30	0.26
Infiltration rate cm/hr	0	60.00	60.00	39.6	30.00	24.00	30.00	24.00	21.60	27.60	24.80	18.20	21.0	18.80	15.60

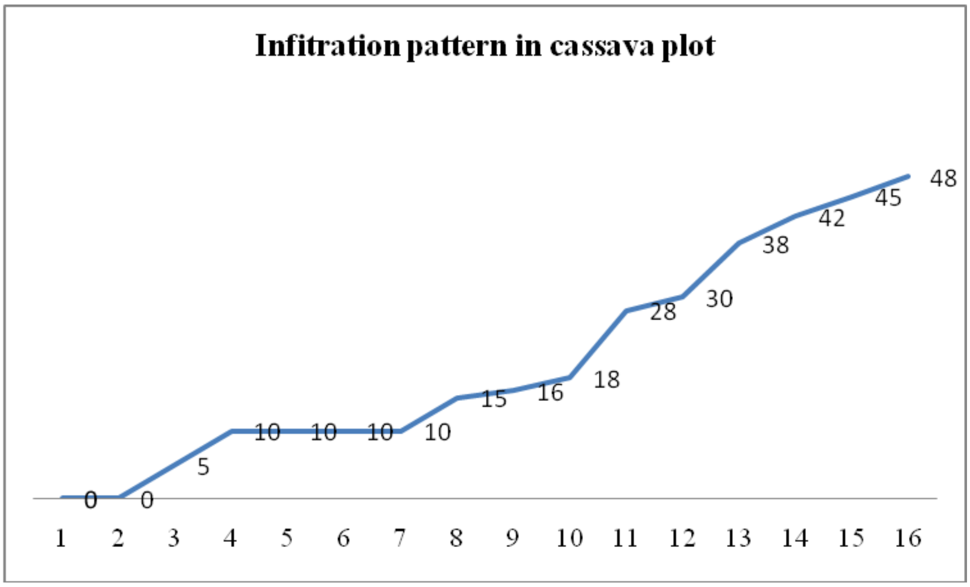

Fig 3: showing infiltration pattern in cassava plot

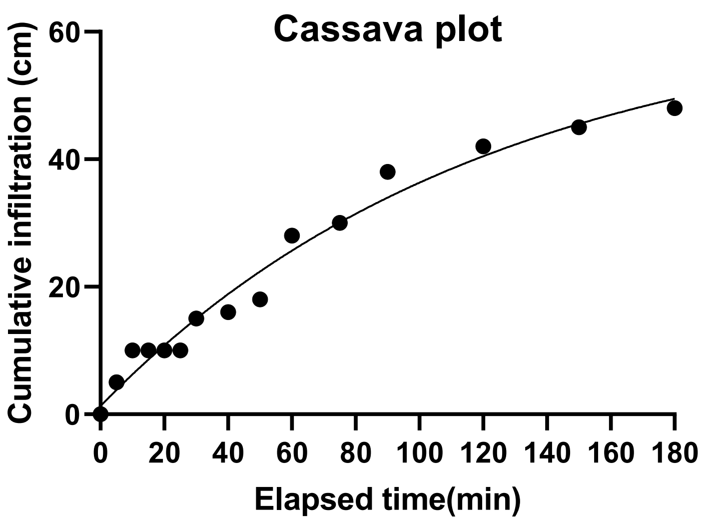

Fig 3b: showing cumulative intake and time in cassava plot

Time interval (minutes)	0	5	5	5	5	5	5	10	10	10	15	15	30	30	30
Cumulative time (minutes)	0	5	10	15	20	25	30	40	50	60	75	90	120	150	180
Cumulative intake (cm)	0	5	10	10	10	15	18	20	25	28	35	37	41	44	46
Infiltration rate (cm/minute)	0	1.00	1.00	0.66	0.50	0.60	0.60	0.50	0.50	0.46	0.46	0.41	0.44	0.29	.25
Infiltration rate (cm/h)	0.00	60.00	60.00	39.60	30.00	36.00	36.00	30.00	30.00	27.60	27.60	24.60	26.4	17.4	15.0

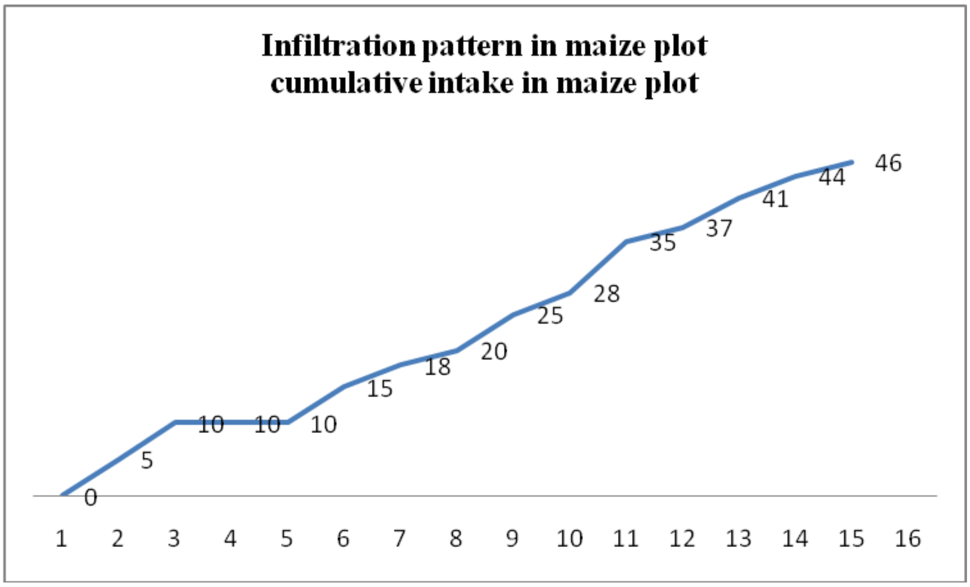

Fig 4a: showing infiltration pattern in maize plot

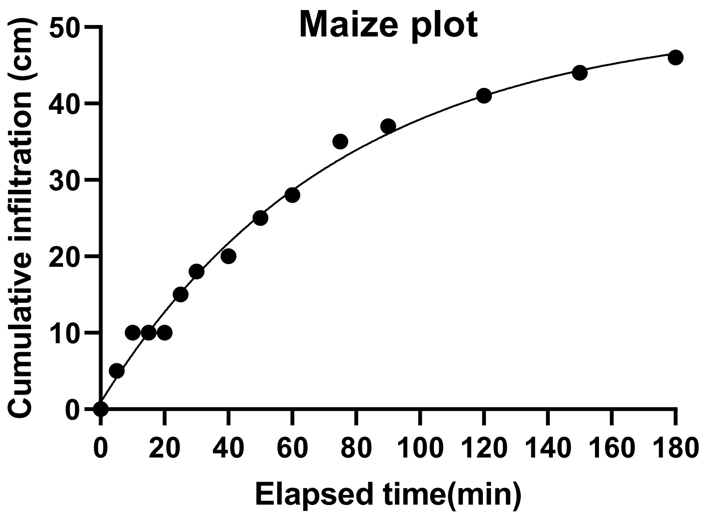

Fig 4b: showing cumulative intake and time in maize plot

5. Discussion

Result of soil textual characteristics is shown in tables 1-4.Salah, et al [34] emphasized the importance of proper understanding of soil textural properties in soil related investigations. Results showed that particle distribution of sand, silt and clay indicate that the soil consists of a monolithic sedimentary characteristic with the predominance of sandy loam soil texture. Sand was the dominant particle size fraction, thus, facilitating shearing due to lack of cohesion. Indubitably, soils that are predominantly sandy are susceptible leaching and water percolation because sand shearing is usually facilitated. Results showed mean values of 76, 73, 75, and 69 per cents for sand; silt had 11, 15, 11, and 20 while clay had 13, 8, 12, and 11 percent for cassava, maize, plantain and oil palm plots respectively. It is evident that the soil has monolithic textural characteristics with huge particle distribution of sand, and little percentages of silt and clay.The experimental sites are all located within the same environmental setting hence, the homogenous textural characteristics. Ideally, they are expected to have similar infiltration pattern assuming they were subjected to same land cover type. It follows that any variation in infiltration rate may be largely linked to differences in land cover types. [35] earlier attributed changes in infiltration rate to soil types, rainfall, vegetation cover, and moisture content prior to the time of investigation. Results of table 5 - 8 showed data of infiltration pattern across various crops cover types. Table 5 showed infiltration patternin plantain plot. Result revealed that infiltration pattern showed a characteristic sluggishmovement from the beginning of the experiment till the end portraying unique flowing pattern. Fig 1a showed that the pattern of infiltration in plantain plot was obviously sluggish slanting vertically and horizontally at the first three runs at accumulative time of 0, 5, and 10 minutes. Seemingly clustered at runs 15-25 and finally peaked with accumulative intake of 44.5cm. fig 1b also showed similar trend

Table 6 showed Average Infiltration pattern of oil palm plot. This land cover type manifested similar infiltration pattern with plantain cover type. Fig 2a & 2b showed infiltration pattern and cumulative intake and time in oil palm plot. It was evidently clear that this land cover type manifested similar infiltration characteristics with that of plantain plot. Water infiltration was very sluggish at the initial stage of the experiment precisely at runs 0, 5, and 10 minutes. Meanwhile, clustering started at between 15 to 30 minutes and peaked at 43.2cm 180minutes of the experiment. Ideally in the measurement of infiltration rate of soil, it is necessary to stop as soon as rate of flow is noticeably steady due to saturation of pores in soil. The case here is different in view of the understanding of textural characteristics of soil with considerably high per cent sand particles that will naturally not resist water seepage. And under dry weather condition, it takes more time and many infiltration runs to attain this status.

Table 7 showed average infiltration rate for cassava plot. Result indicated that infiltration fluctuated along the line. However, the first two runs indicated steady flow of 60cm/hr in the second and third runs. Thereafter the infiltration of water continued uninterrupted until it started to fluctuate at 60 minutes with infiltration rate of 27.6cm/hr and cascaded steadily to 21.00, 18.00 and 15.60cm/hr respectively. Fig 3 showed that at first two runs of cumulative time of 0 - 5 minutes, water appeared not to percolate immediately it was poured into the infiltrometer. This may not be unconnected with underlying soil materials that interfered with immediate water percolation. However, percolation was facilitated swiftly immediately after the short interference, indicating that, probable interference from decomposed organic matter constituting soil material may have exerted very little influence on infiltration of water. This type of scenario can temporarily obstruct water seepage into the soil for a short while in spite of soil textural characteristic. Fig 3b indicating cumulative intake and time also portrayed similar result.

Table 8 shows average infiltration pattern in maize plot. Figures 4a & 4b indicate pattern, cumulative intake and cumulative time. Similar to cassava plot, there was a sharp cascade of water into the soil at cumulative time interval of 0 and 5 minutes. However, the behavior of water into the soil indicated systematic and "sluggish" movement in terms of percolation. And this continued without interference until it peaked at 46cm cumulative intake, and 180 minutes cumulative time. It would be said that the annual crops (cassava and maize) plots in the study area demonstrated what could be described as 'zig zag' but without significant interruption of water infiltration into the soil. This of course may be attributable to the peculiarity of granular soil characteristic. The Result proved that water infiltrated into the soil constantly for about 10 minutes before stopping gradually for another 10 minutes. However, stability was reached between 25 to 30 minutes before the water started seeping in until it got to 60 to 75 minutes of the experiment. Similarly, at 120 minutes, infiltration rate started fluctuating from 26.40, 17.4 to 15.00 cm/hr.

Results from the different experimental plots showed that infiltration rate was progressively moving faster at the initial stage of the experiment except for the plantain and oil palm plots where infiltration was retarded at the initial stage but water started cascading after the first two runs of the experiment. This explains how accumulated in-decomposed plant materials in the soil are capable of preventing water from seeping into the soil. It thus, implies that annual crops in the study area facilitated water infiltration without reasonable interference as they both (cassava and maize) peaked at 46 cm and 48 cm in 180 minutes respectively. While the perennial crops have similar experience of pattern of infiltration showing sluggish in-flow of water at their initial stage and clustered at some point of the experiment. The sluggish pattern of inflow water may not be unconnected with accumulation of decomposed plat materials which have mixed overtime with soil. Annual crops do not have longer time field to enable them produce sufficient residues. It is usually worst when continuous farming is practiced, in such circumstances, the soil is unduly impoverished due to excessive usage.

It is pertinent to note that certain ecological characteristics underlie fluctuation of water percolating into the soil. This perhaps may be attributed to accumulation of organic matter from plant residues over the years. In so far as, decay organic matter over the years can solidify into seemingly hard pan-like structure even after decomposition by soil microorganisms. Oil palm environment may not favour huge microbial fecundity as a consequence of low temperature regime necessitated by microclimatic condition similar to that of forest ecosystem. This is partly because microbial activities are better enhanced by increase in temperature which oil palm plantation may not have in sufficient amount as to facilitate fast decomposition of plant materials compared to areas with relatively high temperature.The steady flow of water especially towards the end of the experiment may not be unconnected with roots penetration into the soil which facilitates percolation of water. Results from the various plots also showed that there was constant fluctuation of water in the area. However, Table 5, 6, 7, and 8 exhibited similar fluctuation characteristics but apparent differences in the rate and time. While cassava and maize plots showed no fluctuation at the beginning of the experiment, plantain and oil palm plots fluctuated at different levels. The reason for such fluctuation may not be unconnected with underlying impediments which interfered with water movement at some points of the infiltration process. This cannot be linked to saturation of water pores otherwise; the cascade of water into the soil would not have continued after fluctuation.

However, infiltration of water across various crops' cover plots may not be delinked from textural characteristics of soil. Similar results were earlier obtains in the area [36] while other authors had reported similar result elsewhere [37]. Soils with high sand fraction are susceptible to high level of infiltration; because shearing is not usually facilitated due to incoherence characteristic of sand soil.. Restrains were observed in oil palm and plantain plots probably because; these plants have long duration in the field. Results of this study showed that, the longer the growth cycle of plant the greater the propensity to produce residues that regulate and control water infiltration into the soil. This explains why tress (oil palm) and perennial plots (plantain) demonstrated spectacular pattern of infiltration from annual crops (cassava and maize). The fallen leaves and decayed plant materials decomposed to enrich the soil texture by enhancing root development that can penetrate deeper into the soil to tap nutrients.

In the rain fed agro-dominant landscape where amount of rain can rarely fall below an average of 2000 mm continuous movement of water accompanied with nutrient is a common feature. According to [34] under such condition, least amount of rain drop may percolate into subsurface aquifer, hence, it cannot be held by soil pores due to lack of coherence amongst soil particles. Thus, surplus water flows into channels and forms a water regime that flows eventually into the nearby water bodies. Such degree of water flow into the nearby water sources may aggravate pollution especially in the context of urban environment. Lal [38] noted the nexus between water-soil-wastes (nutrients) in urban area. There is no doubt that considerable amount of nutrients; example, nitrogen are often forced down the soil along with percolating water resulting in leaching. Infiltration records from the different ground cover types are capable of encouraging leaching of soil nutrient and necessitating soil amendment mechanism (fertilizers) for enhancement of plant growth and development. It therefore implies that for crop production to thrive in the area, soil amendment with fertilizer (organic or inorganic) practice must be prioritized especially for annual crops(cassava, maize).Nkwopara et al [3] examined the loss of soil fertility and attributed it to inherent nature of tropical soils which are worsen by infiltration possibility. Given this level of infiltration, application of fertilizer is inevitable to restore loss nutrient. Egbai et al [24] and Shahin et al [39] examined nutrient dynamics of tropical soils and suggested timely replacement with organic or artificial fertilizers. Meanwhile, Rodelo et al [40] averred that any soil, deficient in nutrient requires soil enhancement with fertilizer in order to guaranteed continuous crop production. However, plant residues from fallen leaves and other plant part for soil quality enhancement was stressed by [41]. Zhang et al [2] examined the effect of organic and inorganic fertilizer in the soil and found that they influence organic carbon and enzymatic activities in the soil whileYue et al [3] posited that organic matter content in the soil is capable of impacting the physical and mechanical properties of soil which in turn facilitate water percolation in the soil.Thus, deficiency in soil humus content as a consequence of unfavourable soil-water relationship in soil will no doubt account for deficiency in organic carbon build-up that influences carbon sequestration. Aisha, et al [42] decried poor organic matter status of tropical soil and linked it to low humus content. Humus in the soil is capable of influencing water percolation. Different crops cover litters offer different degree of soil – water interaction which may either facilitate water infiltration or encourage soil water holding capacity. [5] assessed ecosystem services of crop cover and their ability to foster soil recuperation through humus production. The study focused on the use of various crops cover types in the determination of infiltration pattern of a granulose soil characteristic. This study revealed that highest fluctuation in infiltration pattern was associated with plants with longer growth cycle (plantain and oil palm plots) in contrast to annual crops(maize and cassava). Result showed unequivocal changes in soil hydrologic behaviour which may not beunconnected with prolong deposition of litter falls from plantain leafs and those of undisturbed vegetation in oil palm plot overtime.

6. Conclusion

Assessment of the influence of crop cover types on infiltration pattern of a characteristic sandy soilaim to achieve efficiently compatible soil-water-crop interaction for sustainable crop production. Local farmers are often bereft of modern agricultural practices; hence they resort to traditional practices without recourse to immediate or future environmental consequences of such practices. Undeniably, certain agricultural practices can worsen infiltration rate of soil while some can result in improvement of affected soil. This study revealed that highest fluctuation in infiltration pattern was associated with plants with longer growth cycle (plantain and oil palm plots) in contrast to annual crops, maize and cassava. Result showed unequivocal changes in soil hydrologic function which is connected to biological processes over time. Plants decomposition by microbial activities aids improvement of soil physical characteristics which in turn facilitates water percolation in the soil. The study found that different crops cover types have profound influence on hydrologic characteristics of soil. Perennial crops store considerable amount of soil carbon from the decomposed organic matter than annual crops. Undisturbed soil can produce continuous build-up of biomass and have potential for increased of earthworm population that supports soil development. The significance of this study cannot be over emphasized, in view of the dominant role of agriculture in the economic livelihood of the people hence, the knowledge of infiltration pattern of important crops cover types will enhance robust and focus driven food production practice.

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Authors Contribution:

1 Egbai, Oruk Ohon –Conceived the idea and participated in every aspect of the paper.

2 Ambe, Benjamin Ayua -Framed and designed the methodology

3 Asor, Love Joseph - Conducted the laboratory analysis

4 Afu, Sunday –– Led in the field work evaluation of rill erosion channels

5 Uquetan, Uquetan Ibor –Performed field analysis

6 Eni, DevalsamImoke – carry out statistical analysis

7 Oko, Peter Ereh – Assisted in the production of infiltration graphs..

8 Ojobe, Sunday Uka - contributed new method of evaluating the contribution of respective crops cover types on infiltration pattern.

9 Agorye, Anthony Odobi– Did a thorough literature search

Conflict of Interest Statement:

The authors hereby declare that there is no conflict of interest

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