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CONTENTS

Soil suitability assessment of a humid tropical soil for pineapple (*Ananas comosus*) and plantain (*musa spp*) cultivation in Port Harcourt, Nigeria

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ABSTRACT: This study was carried out at the Teaching and Research Farm of the Faculty of Agriculture, Rivers State University, Port Harcourt, Nigeria to evaluate the soils for their suitability for the cultivation of two arable crops (pineapple and plantain). The area was gridded using the rigid grid method of detailed soil survey, measuring 100 m x 100 m (1 ha) per auger boring point. Two mapping units were identified and delineated based on textural class, drainage, topography and land use types. A soil profile was dug in each of the mapping unit and described appropriate.Soil samples were collected from identified genetic horizons and analyzed for morphological, physical and chemical properties of the soil. The results indicated that, under moist condition, soil in mapping unit 1 (pedon1) had very dark grayish brown (10YR3/2) colour at surface level and strong brown (7.5Y4/5) at subsurface level; while in mapping unit 2 (pedon 2), soil colour was strong brown (7.5YR5/6) at both surface and subsurface level. Textural class in pedon 1 was sandy loam at the Ap1- horizon, sandy clay loam at the Bt2 – horizon; while in pedon 2, soil textural class was loamy sand at the Ap – horizon and sandy clay loam at the Bt2 – horizon with sub-angular blocky to blocky structures in both pedons. Sand particles was dominant mineral size fraction in the soil in both pedons (832 g/kg and 852 g/kg).Silt particles had the least particle size distribution (26 and 26 – 46 g/kg) respectively. CEC ranged from 19.16 cmol/kg to 53.60 cmol/kg in pedon 1 and 12.33 cmol/kg to 18.33 cmol/kg in pedon2. The pH of the soils were acidic to moderately acidic (4.59 to 5.53), organic carbon and total nitrogen were low, ranging from 0.27g/kg to 0.98 g/kg and 0.01 g/kg to 0.14 g/kg. Available phosphorus ranged from 1.75 mg/kg to 48.59 mg/kg and exchangeable bases (Ca, Mg and K) ranged from low to moderate, while the base saturation of the soil were generally high ranging from 75% to 94.69 %. The result on the suitability scores using the Non-parametric methods showed that the soil of the study area were currently not suitable (N) for pineapple and plantain cultivation on the basis of fertility; that is, low CEC and N for pineapple and low CEC and alkalinity for plantain cultivation. It is therefore, imperative to embark on good fertility management practice to boost the fertility status of the soil for sustainable arable crop production.

Key words: Assessment, cultivation, pineapple, plantain, suitability

Soil is extremely important, as it is a vital link and medium for sustainable arable cropping (Peter *et al.*, 2019).Land suitability assessment of soils is key before embarking on any form of agricultural crop production and, it helps to estimate the potential of agricultural land resources through land suitability evaluation process to boost the performance of an agricultural land for specific purposes (Peter and Umweni, 2020a and Eghaghara *et al*, 2021). (Peter and Umweni, 2020a and Eghaghara *et al.*, 2021) It is also the prediction of agricultural land potentials through the conventional process of land suitability classification of an area of land for defined use (Eghaghara *et al.*, 2021). It is imperative that, the use of land for agricultural production should be done based on its capacity for optimum crop production on asustainable basis (Peter and Umweni, 2020a). Nsor and Akpan (2021) also defined land suitability as the ability of a parcel of land to tolerate the production of crop in a sustainable manner. Land suitability assessment allows the identification of the main limiting factors affecting agricultural crop production and provides solution for decision makers to develop its crop management system, thereby increasing land productive capacity on asustainable basis (Peter *et al.*, 2021). Land suitability evaluation on the other hand, is a function of crop requirements and land characteristics, aimed at categorizing better and poor qualities of agricultural land. It suggests the best management practice to improve some of the essential land quality feature as well as sustaining the better land qualities (Peter *et al.,*2019 and Peter *et al.,* 2021).This practice promotes suitable use and proper management of the environment and land resources. Land use requirements are described by the land qualities needed for sustained production

(Peter and Onweremadu, 2015 and Douglas and Peter, 2016). According to Eghagbara *et al.*(2021), plantain and pineapple are major crops grown as both food and cash crops in various communities in Nigeria; adding that Nigeria is the largest producer of plantain in the West African sub-region. Plantain is rich in vitamin A and it is used as staple food as well as raw materials in food industries for the manufacturing of chips, flakes and cakes thus, creating both direct and indirect sources of income for small scale farmers (Kainga and Seiyabo, 2012and Peter and Umweni, 2020a).

MATERIALS AND METHODS

The study was conducted at the Teaching and Research Farm of the Faculty of Agriculture, Rivers State University, Port Harcourt, South-South, Nigeria. It is situated between latitude 4^{o} $40^{1}50^{''}$N and 4^{o} $51^{1}40$''N and longitude $6^{o}57^{1}30$''^{o}E and 7^{o} 5^{1} 0''^{o}E. The climate of the study area is that of the humid tropical with mean annual rainfall of 2000 – 3000mm, while the mean annual temperature ranged between 25 – 28^{o}C (Peter and Aaron, 2019; Ikati and Peter, 2019). There is also a short period of dry season observed in the study area between late November to February in which the study area experiences the harmattan; although this has been altered tremendously as a result severe effect of climate change. The vegetation of the of the study area is also the humid tropical ever green, that has also been altered as a result of continuous cropping system commonly practiced in the area. Soils in the study area are the coastal plain sand of marine deposits (Peter and Aaron, 2019)

Field Study

Field survey was carried out in the selected land area covering the Teaching and Research Farm measuring 30 hectares of land. The entire land area of the Teaching and Research farm was geo-referenced and digitized in an Arc map environment forming a shape field of the study area. The digitized map of the study area was gridded using the rigid grid method of detailed soil surveymeasuring 100 m x100m (1 ha) per auger boring point. A total of Thirty(30) auger boring points were identified.Auger boring was done at depth intervals. Soil samples (auger samples) were describe *in-situ* morphologically to ascertained the soil colour, texture (using hand feeling), structure, drainage, presence of absence of mottles and concretions. Soils with similar properties were grouped to form mapping units. Two mapping units were identified and delineated. Representative profiles pit of 2m x 2m x 2m were dug in each of the mapping unit (pedon) and were described according to FAO (1976)and Anderson and Ingram (1993), starting from bottom to top. Soil samples were collected from identifiable horizons for laboratory analysis.

Laboratory Analysis

The soil samples were air-dried, crushed and sieved with 2 mm sieve. The following soil physical and chemical properties were determined at the Soil Science Laboratory, Faculty of Agriculture, Rivers State University, Port Harcourt: Particle size distribution was carried out using the hydrometer method according to Bouyocus (1962) using calgon (sodium hexameta phosphate) as a dispersing gent. Bulk density was done using the clod method as described by Blake and Hartage(1986). Soil pH was determined in 1:1 water ratio using glass electrode pH metre (Hossner, 1996). Electrical conductivity was determined using electrical conductivity meter. Soil organic carbon content was determined using Walkey and Black (1934) method. Total nitrogen was determined using the Macro Kjeldal digestion method. (Hossner, 1996; Ibitoye, 2008). Available Phosphorus was also determined using the Bray-1 method (Bray and Kurtz, 1945). Exchangeable bases (Ca, Mg, K and Na) were determined using Ammonium acetate saturation method (Ibitoye, 2008). Exchangeable acidity was determined using the EDTA Titration method (Ibitoye, 2008). Effective Cation Exchange Capacity (ECEC) was determined by the summation of total exchangeable bases and total exchangeable acidity and Percent Base saturation was determined by expressing the sum of total exchangeable bases as a function of cation exchange capacity.

Soil classiûcation

Soils of the study area (the Teaching and Research Farm) were classiûed using two conventional methods of the soil taxonomy of the United States Department of Agriculture (2014) and correlated with the World Reference Base for Soil Resources (2014)

Land suitability evaluation procedure

The potential and limitation of land qualities/ properties in evaluating the suitability of soils of the study area for pineapple (*Ananas comosus*) and plantain (*Musa spp*) cultivation was done using relevant land suitability guidelines of Sys (1985),Djaenudin *et al.* (2003) and the FAO frame work for land suitability evaluation (FAO, 2006).

RESULTS AND DISCUSSION

Morphological characteristics of soils in the Study Area

The results of physical properties of soils of the study area as shown in Table 3 indicated that, under moist condition, in Pedon 1, the soil had very dark grayish brown (10YR3/2) at surface level in the Ap1- horizon and, to Strong brown (7.5Y4/5) at subsurface level in Bt1- horizon. In pedon 2, under moist condition, the soils had strong brown coloration (7.5YR5/6) at both surface and subsurface level. The very dark grayish colour also indicated the present of accumulated organic matter as the main colouring agent of most of the top surface soils. The observation was in line with the findings of Akamigbo (1999) that gleization is common with coastal plain soils. This also collaborates the finding of Nsor and Akamigbo (2009) and Peter and Umweni (2021). Soil textural class in pedon 1 ranged from sandy loam in Ap -horizon to sandy clay loam in Bt2 – horizon, but varied from loamy sand in Ap1 -horizon to sandy clay loam in Bt2 – horizon in pedon 2. Soils of the study area were characterized by sub-angular blocky to blocky structures; while consistence was friable, sticky and plastic when moist and wet across the two pedons.Soils of the study area were well drained and this is attributed to their sandy texture and drainage condition of the area.

Physical characteristics of soils in the study area

Table 4 presents the physical properties of soils in the study area. Data on particle size distribution of soils showed that in pedon1, sand particle ranged from 692g/kg to 832 g/kg with mean values of 748 g/kg. This was followed by clay varying from 142 g/kg to 282 g/kg with mean values of 226 g/kg. Silt particles had the least particle size in pedon 1 (26 g/ kg). In pedon 2, sand fraction had the highest particle size distribution that ranged from 692 g/kg in Bt horizon to 852 g/kg in Ap horizon followed by clay ranging from 102 g/kg in Ap horizon to 282 g/kg in Bt horizon. Silt fraction also had the least particle size (26 – 46 g/kg). It was observed that, there were increase in sand particles at soil surface with a decrease down the depth of the profile. The dominant of sand fractions at surface level might be attributed to the influence of the parent materials from which the soils were formed. This in similar to the reports of Akamigbo and Asadu (1982), Akpan-Idiok (2012) and Peter and Umweni (2020a). There were also increase in clay content down the depth of the profile in both pedon 1 and 2. The increase in clay content down the profile depth indicated the present of argillic – B horizon (Bt). This is similar to the findings of Esu (2004) and Peter *et al.* (2019) who reported that occurrence of argillic diagnostic horizon in soils, indicated the activeness of eluviation-illuviation processes in soils. Soils of the study were well drained soils and soil bulk density value range from 1.54 to 1.89 gcm^3 and 1.63 to 2.09 gcm^3 respectively. The high bulk densities observed in the study area, could be attributed to the activities of farm machinery over time.

Chemical properties soils in the study area

The chemical properties of soils in the study are presented in Table 5. The result showed that Electrical Conductivity (EC) values ranged from

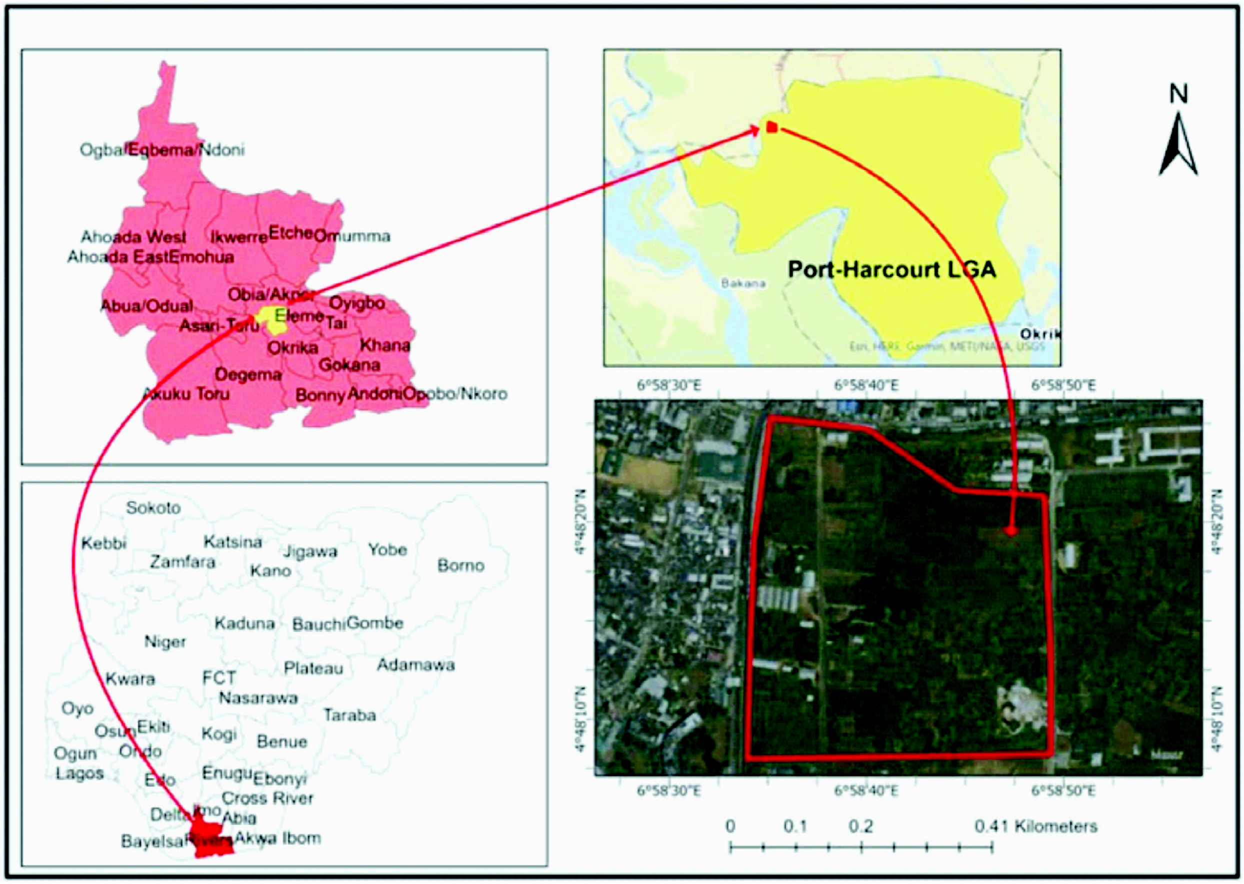

Fig 1: Map of the study area

19.16 – 53.60 dsm^{-1} in pedon 1. The least EC value of 19.16 dsm^{-1} was obtained at the Bt_2 horizon at a depth of 87 – 200 cm. Pedon 2 was found to have the highest EC at the Ab – horizon with a depth of 23 – 80 cm and the lowest EC value of 12.33 dsm^{-1} at a depth of 0 -23 cm.Soil reaction (pH) as shown in the Table 5, revealed that, in pedon 1, pH was slightly acidic (5.41) at soil surface level (Ap_1 horizon) with mean value of 5.31. The Bt_2 horizon in pedon 1 had the least pH value of 4.75 (highly acidic). In pedon 2, pH value was low at surface level (4.65) and 4.59 at subsurface level (Bt_1 horizon) with mean value of 4.80. The soils in pedon 2 were highly acidic when compare to that of pedon 1. The results contradict the findings ofEghaghara *et al.* (2021), who reported that soils in Idoa community, East West LGA in Edo State, Nigeria were acidic at soil surface level and slightly acidic at subsurface level. This trend could be attributed to residual effects of organic amendments applied to the soils over time leading to low pH (slightly acidic) and also as a result of chemical weathering. This collaborated with the findings of Ayolagha and Peter (2011),Peter and Umweni (2020a), Peter and Umweni (2020b) and Peter and Gbaraneh (2021), who also reported that, surface soils were slightly lower in pH than the subsurface. The results show that organic carbon in pedon 1 was very low ranging from 0.27 to 0.98 g/kg. In pedon 2, organic carbon varied from 0.31 - 0.43 g/kg. The low organic content as observed in the soils could be attributed the cropping system (continuous cropping) practiced in the area. The same trend was observed in total nitrogen content of the soils. Total nitrogen values in pedon 1 ranged from 0.01 – 0.07 g/kg; while in pedon 2, it ranges from 0.01 – 0.14 g/kg. The total nitrogen value in the soils of both pedons is an indication of low organic matter accumulation and

Table 1: Climatic, soil and land quality requirements for production of pineapple fruit

Land Qualities/ Characteristics	Suitability class			
	S1 (100)	**S2 (85)**	**S3 (60)**	**NS (40)**
Climate (c)				
Annual rainfall (mm)	>2000	1450 - 2000	800 - 1450	< 800
Mean Temperature (^{O}C)	25 – 30	20 - 25	15 – 20	< 15
Dry season length (months)	1 -2	2 - 4	4 - 6	>6
Wetness (w)				
Flooding	Fo	F1	-	F2
Drainage	Well drain	Moderate	-	-
Imperfect	-	-	-	-
Topography (m)				
Slope (%)	0 – 8	8 - 30	30 – 50	>50
Soil physical characteristic (s)				
Soil depth (cm)	>100	50 - 100	20 - 50	>20
Texture	sl, scl, cl	ls	s	cl
Structure	Any	Any	Any	Any
Soil fertility				
CEC	>16	12 - 16	10 - 12	< 10
N	>35	20 - 35	10 - 20	< 10
OM	>1.8	1.2 – 1.8	0.6 – 1.2	< 0.6
pH	>5.5 – 6	4 – 5.5	6 – 6.9	< 4

Source; Sys (1985) S1= Highly suitable, S2= Moderately suitable, S3 = Marginally suitable, NS = Not suitable, F0 = No flooding, F1= 1 – 2 months flooding, F2= Not more than 2 -3 months in 5 out of 10 years, cl=Clay, scl= Sandy Clay Loam,sl= Sandy loam,ls= Loamy sand.s= Sand,cl=Clay

Table 2: Land requirements for the production of plantain (*Musa spp)*

Land requirement/ Land characteristics	S1	S2	S3	N1
Climate (c)				
Annual rainfall (mm)	1250-1750	1750-2000 1000-1250	1200-2500 750-1000	>2500 - 3000 <750
Length of dry Season (m)	2	2-3	3 -4	>4
Mean Annual temp (^{o}c)	20 – 23	23 – 3018 – 20	30 – 4015 – 18	40 <15
Topography (t)				
Slope (%)	<8	8 – 16	16 – 13	>30
Erosion hazard (eh)	Very low	Low - moderate	Severe	Very severe
Wetness (W)				
Flooding	F0	F1	F2	>F2
Drainage (surface)	Good – moderate	Moderate - poor	Poor – moderate rapid	Very poor rapid
Soil Physical Characteristics (				
Texture (surface)	Fine - medium	Medium – slightly coarse	Coarse	Very coasre
Surface stoniness	<5	5 – 15	15 – 40	40 – 45
Rockout Crops (%)	<5	5 – 18	15 – 25	25 – 30
Soil depth (cm)	>100	75 – 100	50 – 75	50 – 45
Coarse Materials (%)	<15	15 – 35	35 – 55	>55
Fertility (f)				
CEC (mol-Kg^{-1}) clay	>16	Any	8 – 12	5 – 8
Base Saturation (%)	>35	20 – 25	15- 20	10 – 15
pH (H_20)	5 – 6	4.5 5.6	<42 - >7.5	<4
Organic carbon (%) 0-15cm	>1.2	0.8 – 1.2	0.5 – 0.8	0.8 – 0.5
Alkalinity (Esp)	15	15 – 20	20 – 25	>25

Djaenudin *et al.* (2003) Modified from Sys *(*1985)

Table 3: Morphological properties of soils in the study area

Horizon	Depth (cm)	Color (moist)	Texture	Structure	Consistency			Features
					Moist		Wet	
PEDON 1								
Ap1	0-21	10YR 3/2 very dark grayish brown	sl	sbk	Friable	Sticky	Plastic	Abundant root
Ap2	21 – 34	10YR 3/8 strong brown	scl	bk	Friable	Sticky	Plastic	Abundant root
BW1	34-55	10YR 4/6 dark yellowish brown	scl	bk	Friable	Sticky	Plastic	Abundant root
Bt1	55-87	7.5YR 5/8 strong brown	scl	bk	Friable	Non sticky	Plastic	No root
Bt2	87-200	7.5YR 4/6 strong brown	scl	bk	Friable	Highly sticky	Plastic	No root
PEDON 2								
Ap	0-23	7.5YR 5/6 Strong Brown	Ls	sbk	Friable	sticky	Plastic	Less root
BW1	23-80	7.5YR 4/6Strong Brown	Scl	bk	Friable	Non sticky	Plastic	Less root
Bt1	80-200	7.5YR 5/6 Strong Brown	Scl	bk	Friable	sticky	Plastic	No root

sl = Sandy Loam, scl = Sandy Clay Loam, ls = Loamy Sand, sbk = Sub-angular Block, bk= Blocky

Table 4: Physical properties of soils in the study area

Horizon	Depth (cm)	Sand g/kg^{-1}	Silt	Clay	TC	Drainage	BD gcm^3
PEDON 1							
Ap1	0-21	832	26	142	sl	Well drain	1.89
Ap2	21-34	752	26	222	scl	Well drain	1.63
BW1	34.55	752	26	222	scl	Well drain	1.79
Bt1	55.87	712	26	262	scl	Well drain	1.61
Bt2	87-200	692	26	282	scl	Well drain	1.54
	Mean	**748**	**26**	**226**			**1.69**
PEDON 2							
AP	0-23	852	46	102	sl	Well drain	2.09
BW1	23-80	712	26	262	scl	Well drain	1.79
Bt1	80-200	692	26	282	scl	Well drain	1.63
	Mean	**752.**	**32.6**	**215.4**			**1.84**

TC= Textural Class, BD = Bulk Density

decomposition and the high rate of leaching experienced in the area. Available phosphorus in soils of the study area ranged from 7.02 – 48.59 mg/kg in pedon 1 and 2.29 – 24.56 mg/kg in pedon 2. The level of phosphorus in both pedons is ideal for heavy P feeders. This is in line with the report of Douglass and Peter (2015) and Nsor and Akpan. (2021). Cation exchange capacity in both pedons were low to medium, ranging from 4.89 – 6.10 cmol/kg in pedon 1 and 4.20 – 7.34 mg/kg in pedon 2. This collaborated with the reports of FMANR (1990), Douglass and Peter (2015),Nsor and Akpan (2021), who reported that these values were within the range of medium fertility. Exchangeable calcium in both pedons were medium (2.8 – 4.6 cmol/kg and 1.8 – 4.8 cmol/kg), magnesium was medium to high in both pedons (0.6 – 1.2 cmol/kg and 0.1 – 2.2 cmol/kg). Potassium was low to medium in pedon 1 (0.11 – 0.21 cmol/kg) and low in pedon 2 (0.08 – 0.10 cmol/kg). The low to medium level of exchangeable cations in the soils might be attributed to the cropping system (continuous cropping) and leaching

Table 5: Chemical properties of the soils in the study area

Horizon	Depth (CM)	EC (ds/cm)	pH (H20)	OC (gkg^{-1})	TN	Av.P ($mgkg^{-1}$)	CEC $cmolkg^{1}$	Ca	Mg $cmolkg^{1}$	K	BS (%)
Pedon 1											
Ap1	0-21	42.7	5.41	0.66	0.07	48.59	6.1	4.6	0.6	0.11	87.68
Ap2	21-34	32.9	5.53	0.39	0.01	12.81	6.93	4.4	1.6	0.13	89.01
BW1	34-55	30.7	5.4	0.27	0.07	7.02	5.98	4.4	0.8	0.14	89.89
B_t1	55-87	53.6	5.45	0.31	0.07	17.54	5.73	3.2	2	0.21	94.69
B_t2	87-200	19.16	4.75	0.98	0.07	3.59	4.89	2.8	1.4	0.21	90.77
	Mean	**35.81**	**5.31**	**0.52**	**0.056**	**17.91**	**5.93**	**3.88**	**1.28**	**0.16**	**90.41**
Pedon 2											
Ap	0-23	12.33	4.65	0.43	0.14	2.29	5.52	1.8	2.2	0.08	75.13
BW1	23-80	18.33	5.16	0.39	0.07	24.56	4.2	3.8	1	0.08	93.01
B_t1	80-200	12.49	4.59	0.31	1	1.75	7.34	4.8	1	0.1	81.77
	Mean	**14.38**	**4.8**	**1.13**	**0.028**	**12.86**	**5.69**	**3.46**	**1.06**	**0.09**	**83.3**

EC: Electrical Conductivity, OC: Organic Carbon, AVP: Available Phosphorus, CEC: Cation Exchange Capacity and TN: Total Nitrogen

Table 6: Summary table for land suitability evaluation for pineapple (*Ananas comosus*) cultivation

Land Qualities/ Characteristics	Land suitability class	
	P1	**P2**
Climate (c)		
Annual rainfall (mm)	2000 – 3000 (S1)	2000 – 3000 (S1)
Mean Temperature (^{O}C)	25 – 28 (S1)	25 – 28 (S1)
Dry season length (months)	2 (S1)	2 (S1)
Wetness (w)		
Flooding	None (S1)	None (S1)
Drainage	Well drain (S1)	Well drain (S1)
Imperfect	-	-
Topography (m)		
Slope (%)	0 – 4 (S1)	0 – 4 (S1)
Soil physical characteristic (s)		
Soil depth (cm)	200 (S1)	200 (S1)
Texture	sl and scl (S1)	lsand scl (S1)
Structure	sbk and bk (S1)	sbk and bk (S1)
Soil fertility		
CEC	6.10 (N)	5.52 (N)
N	0.07 (N)	0.14 (N)
OM	0.66 (S3)	0.43 (N)
pH	5.41 (S2)	4.65 (S2)
Aggregate Suitability class	N (f)	N (f)
Size (Hectare)	**18**	**12**
% Coverage	**60**	**40**

• Pedons 1 and 2 (30 ha) were currently Not suitable (N) for pineapple cultivation due to limitation in fertility (low CEC and N)

and the origin of the soils. Both pedons had high percent base saturation (87.68 – 94.69 %).

Soil suitability evaluation for pineapple (Ananas comosus)

Table 6 is the summary table for land suitability evaluation for pineapple cultivation in the area. The results showed that when climatic factors (mean annual temperature, rainfall and length of dry season), wetness (flooding and drainage), topography (slope) soil physical characteristics (soil depth, texture and structure) were matched with land quality, they were all highly suitable (S1) for pineapple cultivation in the area. Data obtained on soil fertility (pH) was moderately suitable (S2) in

Table 7: Summary table for land suitability evaluation for plantain (*Musa spp*) cultivation

Land requirement/ Land characteristics	Land suitability class	
	P1	P2
Climate (c)		
Annual rainfall (mm)	2000 – 3000 (S3)	2000 – 3000 (S3)
Length of dry Season (m)	2 (S1)	2 (S1)
Mean Annual temp (°c)	25 – 28 (2)	25 – 28 (S2)
Topography (t)		
Slope (%)	0 – 4 (S1)	0 – 4 (S1)
Erosion hazard (eh)	Very low (S1)	Very low (S1)
Wetness (W)		
Flooding	None (S1)	None (S1)
Drainage (surface)	Well drain (S1)	Well drain (S1)
Soil Physical Characteristics (s)		
Texture (surface)	Fine (S1)	Fine (S1)
Surface stoniness	None (S1)	None (S1)
Rockout Crops (%)	None (S1)	None (S1)
Soil depth (cm)	200 (S1)	200 (S1)
Coarse Materials (%)	None (S1)	None (S1)
Fertility (f)		
CEC (mol-Kg^{-1}) clay	6.10 (N)	5.52 (N)
Base Saturation (%)	87.68 (S1)	75.13 (S1)
pH (H_20)	5.41 (S2)	4.65 (S2)
Organic carbon (%) 0-15cm	0.66 (S3)	0.43 (N)
Alkalinity (Esp)	None (N)	None (N)
Aggregate Suitability class		
Size (Hectare)	**18**	**12**
% Coverage	**60**	**40**

- Pedons 1 and 2 (30 ha) were currently Not suitable (N) for plantain cultivation due to limitation in fertility (low CEC and Alkalinity)

both pedons, organic carbon was marginally suitable (S3) in pedon 1, but not suitable (N) in pedon 2. CEC and total N were not suitable (N) in both pedons. Aggregate suitability land evaluation by limitation (Table 6), using non-parametric method for pineapple cultivation in the study area indicated that currently, the soil is not suitable (N) due to limitation in fertility (low CEC and N).

Soil suitability evaluation for Plantain (Musa spp)

Land suitability evaluation data for plantain cultivation in the study area are shown in Table 7. The results showed that climatic factors (mean temperature and length of dry season) were moderately suitable (S2) and highly suitable (S1) respectively; while mean annual rainfall (>2500 mm) made the study area marginally suitable (S3) for plantain cultivation. This is similar to the finding of Ogburia (2006),Ajiboye and Olaniyan, (2016), Peter and Umweni, (2020), Peter and Umweni, (2021 b) who reported that excessive rainfall reduced plantain productive capacity, leading to low fruit production, dead of swords and suckers and excessive leaf growth at the expense of fruiting and recommended that rainfall of 1891 mm will enhanced good plantain production. Other characteristics such as topography (slope and erosion hazard), wetness (flooding and drainage), soil characteristics (texture, surface stoniness, soil depth and coarse materials) makes the soils highly suitable (S1) for plantain cultivation in the study area. This also collaborated with the findings of Peter and Umweni (2020) who reported thatland suitability classes of soils for plantain production in the Khana local government area indicated that topography, soil characteristics and some soil fertility parameters in the study area were all at optimal level of suitability for plantain production. Data on soil fertility for plantain cultivation in the area showed that per cent base saturation for both pedons also makes the soils highly suitable (S1), pH (H_2O) also make the soils moderately suitable (S2), organic carbon content of the soils make it marginally suitable (S3) for plantain cultivation. Soils of the study area were currently not suitable (N) due to limitation in soil fertility status (low CEC and Akalinity) as indicated in Table 7.

CONCLUSION

In spite of the great important attached to detailed soil information to boost agricultural production, such information is lacking. The data from the soils of the study sites were currently not suitable (N) for both pineapple and plantain cultivation due to limitation in soil fertility (low CEC and N) for pineapple and (low CEC and Alkalinity) for plantain. Thus, good fertility management practice should be adopted in the study area by incorporating organic matter to soils of the study sites in other to improve the soil from its currently not suitable (N) condition to moderately suitable (S2) or highly suitable (S1) for the cultivation of the both the both arable crops of interest.

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