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SUITABILITY EVALUATION OF RAINFED RICE (*ORYZA SATIVA*) IN FLOOD PLAIN OF SOUTHERN GUINEA SAVANNAH ZONE OF NIGERIA

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ABSTRACT

The flood plain of Awe in Southern Guinea Savannah Zone of Nigeria was studied for rice production. The physical, morphological and chemical properties of the soils were matched with the requirements of the rice production and the overall suitability rating of the soils was obtained using limitation method. The soils were deep (101cm – 170cm) and well drained, poorly to very poorly drained. The soils were fine textured and strongly to moderately acidic and slightly alkaline in reaction (pH 5.10 – 7.15). The percentage sand fraction ranged from 44.8% to 83.1%; silt 5.4% to 9.4% and clay 9.4% to 46.7%. They had low to moderate organic carbon (0.41% to 3.52%); total N (0.04% to 0.11%); available P (1.64mglkg^{-1} to 3.72mg/kg^{-1}), total exchangeable bases (2.85cmol/kg^{-1} to 7.97cmol/kg^{-1}), CEC (4.10cmol/kg^{-1} to 7.98cmol/kg^{-1}), base saturation (65% to 97.5%) and Fe^{2+} (1.10 to 2.11). Soils of the three flood levels (toeslope or deep swamp, medium or lower slope, levee or shallow swamp) were rated highly to suitable ($S_{1)}$ because of the soils ability to retain water during the growth period with the favourable physical and chemical characteristics such as climate, slope, water levels, pH and texture. Management practices such as organic matter incorporation, liming to increase soil pH, fertilizer application and appropriate time of planting are hereby recommended for increased rice production in the mapping units that are not highly suitable for rice production in the study area.

Keywords: Suitability; Evaluation; Rainfed Rice; Flood Plain.

INTRODUCTION

It is no secret that the Nigeria's demand for food especially grain is accelerating as population and per capita consumption increase at an unprecedented rate (Usman, 2021a). The quest to grow food including rice to meet that demand and feed the Nigeria population will continue to be one of the most important issues of our time (Ali *et al.*, 2020). Rice is one of the major sources of income to farmers who are engaged in small land areas of about 0.4 hectares on the average. It is one of the main staple foods in Nigeria (Ufot, 2012; Ogbu *et al.*, 2021a) and the world at large. Its demand for domestic consumption, ceremonial purpose, economic growth, and export for foreign exchange return is on the increase along with low production and discouraging yield (Ogbu *et al*., 2019).

Generally, farmers need adequate information on soil properties which will significantly help in the management of the soil and its suitability rating for the crop (Idoga and Ogbu, 2012; Ali *et al.*, 2021). Parcels of land vary in their suitability for use and adaptable management. For rice production, edaphic factors (soil) and climatic factors like rainfall and temperature are critical for farmers to obtain maximum yield on their farms (Fasina *et al.*, 2007). Responses of rice to soil properties and sustainable management practices have been documented in the southern guinea savannah zone of Nigeria (Usman *et al.*, 2018a; Ali *et al.*, 2021; Ogbu *et al.*, 2021a and 2021b), but little attention is given to its suitability to the flood plain soils of the zone. Similarly, little effort has been made in research to establish the best sustainable management of flood plain soils for efficient rice production in this zone. Therefore, the objective of this research was to evaluate the suitability of the flood plain soils for rice production with the aim to establishing best management practices for increased rice production in the study area.

MATERIALS AND METHODS

Study area

The study was carried out at south- eastern block of Nasarawa State stretching from Jangwa in the North East to Gidan Tindi in the South. The study area falls within Southern guinea savannah zone of Nigeria. The land area is geomorphologically referred to as Jangwa flood Plains. It lies between latitude 7^{o} 45$^{'}$ and 9^{o} 25$^{'}$ N and longitude 7^{o}32$^{'}$ and 9^{o} 37$^{'}$ E and covers a total area of over 22,000 hectares of Fadama along Rivers Shankodi, Wuse and Ankwe (Fagbemi and Akamigbo, 1986; Gani *et al.,* 2022).

Field and laboratory studies

A reconnaissance survey was carried out in the area. Based on the local relief/drainage, three soil units were mapped out as soils on Levee, soils of the lower slope from the surrounding upland and the soils over toeslope between the lower slope and the levee corresponding to shallow swamp (>0cm), medium swamp (lower slope) (0-50cm), and deep swamp (>50cm). Auger point investigation were carried out across the slope according to the topographic positions mentioned above. Two profile pits were sunk in each of the topographic positions, giving a total of 6 profile pits. Each profile pit was described according to the guideline for soil profile description (Soil Survey Staff, 2014) and samples collected from identified soil horizons into polythene bags carefully labelled and taken to the laboratory for physical and chemical analysis using standard analytical procedures (Table 1 and 2).

Land evaluation

Suitability evaluation of the soils was carried out using the guidelines of the frame work for land evaluation (FAO, 2015; Usman *et al.,* 2018b). Climate (annual rainfall and temperature), topography (slope) and soil physical and chemical characteristics (soil depth, texture, drainage, pH, available P, total N, Organic Matter, CEC, BS and soil type) were key factors considered in the evaluation. Using a simple limitation method, the identified soil units were placed in suitability classes by matching their characteristics with the requirements of the crop (Rice). The suitability of each factor for respective soil unit was classified as highly suitable (S1), moderately suitable (S2), marginally suitable (S3) and/or not suitable (N) (Table 3). The profile descriptions summarizing the soil characteristics are presented (Table 4) to give over view of the soil information alongside other land characteristics in order to arrive at aggregate suitability classes as well as actual suitability of flood level and topographic position (Table 5).

RESULTS AND DISCUSSION

Morphological and physico-chemical properties of soils of the study area

The major surface characteristics are gilgai micro-relief and poor drainage as indicated by the presence of mottles at the surface. Soil structure is well developed and soil texture is generally sandy clay loam to clay loam at surface and clay at subsurface. The surface soil is moderate- fine subangular blocky to strong subangular blocky at the subsurface. Soils in unit 2 (lower slope flood level) were generally low-lying and nearly flat and covers about 35% of the study area. The texture is generally clay loam to loamy sand to sandy loam at the surface and clay loam to clay at subsurface. In the case of unit 3 (Levee flood level), it is located by the river bank and relatively more elevated and nearly flat. The soils in both locations are somewhat poorly drained. Soil texture is sandy clay loam at surface and clay at subsurface. Soil structure is well developed being medium subangular blocky at the surface and at subsurface is strong coarse subangular blocky.

Generally, the soils are relatively high in clay content. The values of the surface horizons ranged from 8.6% to 34.6%. The relatively high clay content could be due to nature of the underlying geological materials (shales). The Awgu Shales are presumed to have constituted the underlying geology of the area. Clay is the dominant mineral in shale and therefore tends to accumulate when shale weathers (Idoga and Azagaku, 2005; Usman *et al.*, 2022). Alluvium is another geologic material in the area, being an inland depression (Ogbu *et al*, 2021a; Usman *et al.*, 2022). The fine materials are deposited here probably because of the reduction in the velocity of flow of rivers due to low slope gradient. The relative differences in clay content among the pedons could be due to slight difference in topography and cultivation. Sand fraction was most the dominant particle size at surface and subsurface horizons in all the mapping units.

The high sand fraction is a feature of most savannah soils due to eluviations and illuviation processes as well as the effect of erosion and lessivage. Soils with high sand fractions are vulnerable to erosion because they can easily be detached where heavy down pour and running water are frequent (Usman, 2021b). The silt fraction was irregular with depth in most of the units due to the rate of materials brought by flood (flash and river flood). The pH values generally across the study area indicate that the soils were moderately acidic to slightly alkaline in reaction (5.10 – 7.15). This pH levels fall within the range (4.5 – 7.5) considered highly suitable for rice production.

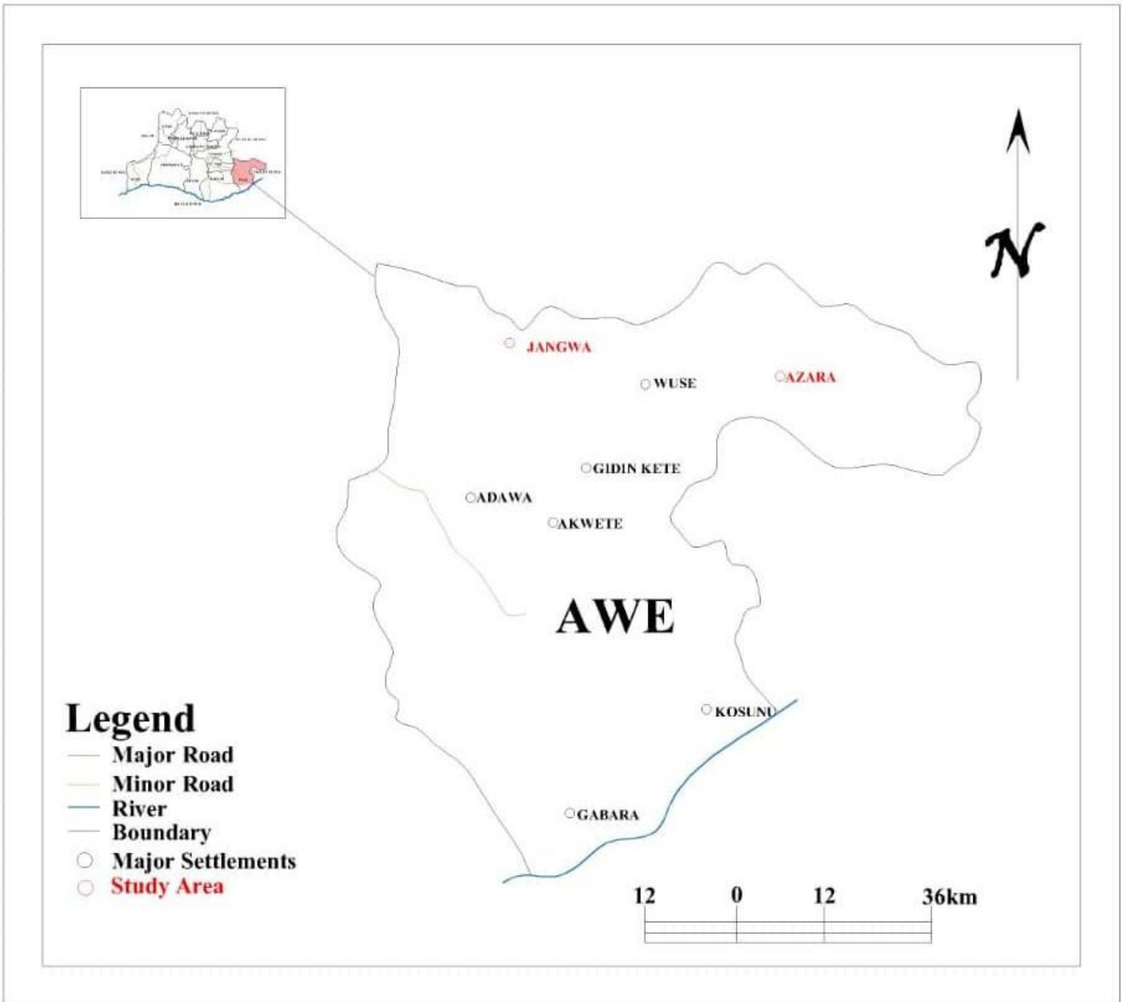

Figure 1: Map of Awe showing the Study Sites

The pH values decreased with depth from surface to subsurface in both locations. This decrease with depth may probably be due to the effect of nutrient biocycling (Idoga and Azagaku 2005; Ibrahim *et al.*, 2022a). The percentage organic carbon content in the study area was low to moderate; it ranged from (0.41 to 3.62). The values decreased with depth in all the Pedons due to the concentration of plant roots and plant residues on the topsoil.

The high values may be attributed to the "aquic moisture" conditions of the flood plains, which reduce soil temperature and consequently lower the rate of organic matter decomposition (Usman *et al.*, 2020). Total Nitrogen values of the soil ranged from 0.05 to 0.11%. This is rated low at the surface and high in the subsurface. Low nitrogen is attributed to release from plant tissues, gaseous loss, loss in surface runoffs, leaching, climatic factors, vegetation, human activities and initial soil/pH (Usman, 2015).

Table 1: Morphological Description of the Study Area

Profile 1: Toeslope – Vertic Epiaqualfs/stagnic lixisols

Depth	Munsell colour (moist)	Mottling	Texture	Structure	Boundary	Inclusions	Consistency
0 – 32	10YR 2/2		SCL	2msbk	CS	Common fine roots	SSW
32 – 57	10YR 3/2	10YR 3/1fif	C	2msbk	GS	Common fine roots	VSW
57 – 96	2.5Y5/2	10YR 5/8cif	C	2msbk	GS	Common fine roots	VSW
96 – 120	2.5Y 5/3	10YR 6/4cif	C	2msbk	GS	Fine roots	VSW
120 – 170	10YR 4/4	7.5YR 4/6cid	C	2msbk	GS	Fine roots	SW
Profile 2: Toeslope – *Vertic Epiaqualfs/stagnic lixisols*							
0 – 35	10YR 2/2		CL	2msbk	CS	Many fine and medium roots	SSW
35 – 61	10YR 3/3	7.5YR 4/4fif	C	2msbk	GS	Common fine and medium fine roots	VSW
61 – 94	2.5Y 5/6	7.5YR 6/4cif	C	2msbk	GS	Fine roots	VSW
94 – 122	2.5Y 5/2	10YR 5/8cid	C	2msbk	GS	Few fine roots	VSW
122 – 170	2.5Y 5/6	10YR 5/8cid	C	2msbk	GS	Few fine roots	VSW
Profile 3: lower slope – *Vertic endoqualfs/stagnic lixisols*							
0 – 10	10YR 5/4		LS	2msbk	CS	Common fine root	SSW
10 – 22	7.5YR 4/4		LS	2msbk	GS	Few fine roots	VSW
22 – 89	7.5YR 5/6		SL	2msbk	DS	Few fine roots	VSW
89 – 101	7.5YR 4/6		SCL	2msbk			SW

Table 1: Cont.

profile 4: lower slope – *Vertic endoqualfs/stagnic Lixisols*

Depth	Munsell colour (moist)	Mottling	Texture	Structure	Boundary	Inclusions	Consistency
0 – 14	10YR 4/2		SL	3csbk	GS	Common fine roots	SSW
14 – 25	10YR 5/6		SL	3csbk	GS	Common fine roots	VSW
25 – 78	7.5YR 4/6		SL	3csbk	GS	Common fine roots	VSW
78 – 110	10YR 5/8		SL	2msbk	GS	Few fine roots	VSW
110 – 150	7.5YR 6/4		SCL	2msbk	GS	Few fine roots	VSW
Profile 5: Levee – *Aeric Endoaqualfs/Aeric Lixisols*							
0 – 22	10YR 4/2		SCL	3csbk	CS	Many fine and medium roots	VSW
22 – 57	10YR 5/6		SCL	2msbk	DS	Common fine roots	VSW
57 – 89	10YR 4/3		SCL	2msbk	DS	Common fine roots	VSW
89 – 101	2.5Y 5/1	10YR 6/3	SCL	2msbk	DS	Few fine roots	VSW
101 – 150	5YR 3/2		LS	2msbk	DS	Nodules	VSW
Profile 6: Levee – *Aeric Endoaqusalfs/Aeric Lixisols*							
0 – 22	10YR 2/2		CL	3csbk	CS	Many fine and medium roots	SW
22 – 53	10YR 5/6	7.5YR4/6	CL	2msbk	CS	Common fine roots	VSW
53 – 92	10YR 5/6	2.5Y5/6	CL	2msbk	DS	Fine roots	VSW
92 – 115	10YR 5/2		CL	2msbk	DS	Fine roots	VSW

Mottling Details:
FIF = Few fine faint, C2D = Few Common medium distinct, M3P = Many coarse prominent, C3P = Common coarse prominent Texture
S = Sandy, C = Clay, SL = Sandy Loam, SCL = Sandy Clay Loam, SC = Sandy Clay Structure
3CCR = Strong Coarse Crumb, 2CCOr = Moderate Coarse Crumb, 2MCR = Moderate Medium Crumb, 2MSBK = Moderate Medium Subangular blocky, 2MFBK = Moderate Fine Subangular Blocky, 3 CSBK = Strong Coarse Subangular Blocky, 3MSBK = Strong Medium Subangular Blocky Consistence
SSW = Slightly Sticky Wet, VSW = Very Sticky Wet, VPW = Very Sticky Wet, SW = Stick Wet, NSW = Non-Sticky Wet, NPW = Non-plastic Wet Inclusion
C2F = Common Medium Faint, M2D = Many Medium Distinct, F1F= Few Fine Faint, C3D = Common Coarse Distinct Boundary
DS = Diffuse smooth, GS = Gradual Smooth, CS = Clear Smooth, AS = Abrupt Smooth Colour DB = Dark Brown, VDGB = Very Dark Grayisn Brown, LB = Light Brown, SB = Strong Brown, RY = Redishn Yellow, BRB = Dark Redish Brown, RG = Redish Green, DYB = Arkn Yellowish Brown, G = Gray, B = Brown.

Table 2: Cont.

Table 2: Some Physical and Chemical Properties of the Inland Wetland Soils of Study Areas

Horizon	Depth (cm)	Particle Size dist Sand	Silt (%)	Clay	Texture	pH H_2O	Org. C	Total N %	Avail. P Mg/kg	Exchangeable Bases Ca	Mg	K	Na	TEB (Coml kg)	CEC	BS %	Fe
Profile 1: Toeslope *Vertic Epiaqualfs/stagnic lixisols*																	
Ap	0-32	62.0	7.4	30.6	SCL	7.10	3.62	0.06	3.35	1.82	1.34	0.86	0.77	4.79	4.89	72	1.25
B	32-57	48.0	7.6	44.4	C	6.99	1.6	0.07	3.26	2.94	1.86	0.93	0.56	6.29	6.29	78	1.10
Bt_1	57-96	47.0	6.4	46.6	C	6.98	2.54	0.08	2.21	3.67	2.48	0.89	0.03	7.97	7.98	91	1.46
Bt_2	96-120	49.0	7.4	43.6	C	5.86	0.72	0.06	2.42	2.47	1.65	0.42	0.84	5.38	5.49	72	1.45
Bt_3	120-170	47.0	5.4	47.6	C	5.53	2.10	0.04	1.67	1.64	1.34	0.64	0.53	4.15	4.26	65	1.50
Profile 2: Toeslope -*Vertic Epiaqualfs/stagnic lixisols*																	
Ap	0-35	52.1	8.0	30.9	CL	7.15	2.65	0.05	3.56	2.34	1.86	0.95	0.82	5.97	5.98	73	1.60
B	35-61	50.0	7.1	42.7	C	6.58	2.88	0.08	2.25	2.78	2.02	0.41	0.36	5.55	5.67	65	1.76
Bt_1	61-94	44.8	8.4	46.8	C	6.24	1.54	0.06	3.51	3.37	2.62	0.82	0.72	7.53	7.33	91	1.72
Bt_2	94-122	48.0	7.3	44.7	C	5.25	2.72	0.05	2.62	3.43	2.14	1.58	0.42	7.57	7.69	77	1.98
Bt_3	122-170	48.0	6.6	43.4	C	5.14	1.25	0.04	2.42	2.34	2.31	0.32	0.64	4.45	4.74	81	2.01
Profile 3: Lower slope-*Vertic endoqaualfs/stagnic lixisols*																	
A	0-19	86.0	5.4	8.6	LS	6.89	1.65	0.04	3.29	3.68	1.42	0.46	0.55	5.06	7.26	69.9	1.43
AB	10-22	79.0	7.4	13.6	LS	6.85	0.61	0.08	3.61	3.66	2.41	0.35	0.37	6.33	6.98	91.0	1.39
B	22-89	75.0	6.5	18.5	SL	6.75	1.59	0.06	3.72	3.65	1.36	0.36	0.18	5.59	6.57	83.3	1.28
BC	89-101	61.0	8.2	30.8	SCL	6.13	2.52	0.05	2.55	3.15	1.20	0.30	0.24	4.91	6.38	77.2	1.56

		Particle Size dist						**Total N**	**Avail. P**	**Exchangeable Bases**				**TEB**	**CEC**	**BS**	**Fe**
Horizon	**Depth (cm)**	**Sand**	**Silt**	**Clay**	**Texture**	**pH H2O**	**Org. C**	**%**	**Mg/kg**	**Ca**	**Mg**	**K**	**Na**			**%**	
		→	**(%)**	←						→				**Coml kg**	←		
Profile 4: Lower slope–*Vertic endoaqualfs/Stagnic Lixisols*																	
Ap	0-14	83.1	7.2	9.7	SL	6.80	2.72	0.05	3.36	3.68	2.34	0.41	0.62	7.05	7.23	97.5	1.48
A	14-25	80.3	7.0	12.7	SL	6.72	2.61	0.08	2.28	3.67	0.95	0.39	0.37	5.38	6.94	77.5	1.52
AB	25-78	76.0	9.2	14.8	SL	6.70	1.59	0.07	3.21	3.05	1.68	0.38	0.16	5.27	6.67	79.0	1.76
	78-110	77.0	10.2	12.8	SL	6.30	0.72	0.11	2.75	3.15	1.25	0.32	0.11	4.83	6.36	75.9	1.98
Bt_3	110-130	70.4	8.2	21.4	SCL	5.26	1.42	0.06	2.68	1.35	1.32	0.28	0.17	3.21	4.10	78.2	2.11
Profile 5: Levee -*Aeric Endoaqualfs/Aeric Lixisols*																	
Ap	0-22	60	6.4	33.6	SCL	5.43	2.06	0.05	3.12	1.87	0.56	0.37	0.60	3.40	5.02	84.5	1.58
Bt_1	22-57	58	9.4	32.6	SCL	5.35	1.56	0.07	2.98	2.56	0.53	0.35	0.38	4.02	4.93	81.5	1.69
Bt_2	57-89	62	7.4	30.6	SCL	5.14	1.52	0.08	3.26	2.14	1.34	0.31	0.34	4.13	4.34	95.1	1.90
Bt_3	89-101	60	8.5	31.6	SCL	5.10	0.41	0.06	1.87	2.11	1.20	0.30	0.21	3.82	4.22	90.5	2.06
Bt_3	110-130	82.6	8.2	9.4	LS	5.25	1.42	0.05	2.36	2.15	1.12	0.28	0.22	3.77	4.10	91.9	2.11
Profile 6: Levee –*Aeric Endoaqualfs/Aeric Lixisols*																	
Ap	0-22	59.0	6.4	34.6	CL	5.40	1.53	0.07	3.27	2.67	1.40	0.37	0.25	4.69	5.62	93.4	1.36
Bt_1	22-53	54.0	9.2	36.8	CL	5.35	1.53	0.08	2.50	1.56	0.68	0.35	0.38	2.97	5.22	90.3	1.48
Bt_2	53-92	58.0	7.4	34.6	CL	5.14	1.44	0.05	2.15	2.14	1.06	0.30	0.31	3.81	4.33	87.9	1.64
Bt_3	92-115	53.2	8.6	38.2	CL	5.12	1.34	0.04	1.64	2.13	0.23	0.29	0.20	2.85	4.15	68.6	1.92

The phosphorus content of the study area was extremely low with values ranging from 1.64 to 3.72mg/kg. The low values however agree with the views of (Usman *et al.,* 2020) that the total quantity of phosphorus in most native soil is low, with most of it present in the form quite unavailable to plants. The low available phosphorus may be attributed to low amount of organic carbon of the flood plains. The exchangeable bases (Ca, Mg, K and Na) are low in both locations of the research. The low exchangeable bases may be attributed to the nature of the underlying materials, intensity of weathering, scorching, low activity clay very low organic matter content, surface runoff and the lateral translocation of bases (Ibrahim *et al.*, 2022b). The CEC values ranged between 4.10 and 7.98cmol/kg^{-1}. The CEC of the soils of the study area was low to medium according to Esu (1991) rating of <6 = low, 6-2 = medium and <12 = high. The low CEC values of the soils could be attributed to the nature of the silicate clay minerals (Kaolinite) believed to be the dominant clay type in depressed soils. The percentage base saturation values of the soils (65 to 97.5%) were rated moderately high to very high. The distribution of base saturation is irregular in all the units. This could be attributed to the active plant litter decomposition process which incorporated cations from the litter into the soil surface and also the contribution by harmattan dust known to contain some high fraction of cations especially Ca (Ogbu *et al.,* 2021a; Ali *et al.*, 2022).

Suitability Status of Soil of the Study Areas for Rainfed Rice Production

Suitability ratings of both locations of study as it influenced the cultivation of rice are shown in Table 3. The assessment ratings resulting from matching of land qualities and their requirements for rice is presented in table using the FAO (2015) suitability ratings.

The annual rainfall for both locations was highly suitable (S_1) except where no adequate rainfall during the cropping season during the year they may experience drought where no adequate rainfall (S_3).

Mean Temperature for both locations was high and suitable for rice (S_1) on the basis of texture, both locations were highly suitable. The slope <2% made both locations of study highly suitable (S_2). However, slope of <3% may favour mechanical operations. The entire Pedons were moderately drain (S_2) for rice production.

On soil reaction (pH), both locations were highly suitable (S_1). Base saturation was high across both locations; which indicates high fertility in the areas. This could be as a result of the non-acidic condition of the soils. Soils with high base saturation percentage have high pH and are more buffered against acid conditions for plant roots and they also contain greater amount of the essential plant nutrients for use by plants (Agber *et al.*, 2017). Considering nutrient retention ability (CEC) both locations were marginally suitable (S_3). Organic carbon content of both locations was marginally low (S_2). Total nitrogen was moderately suitable (S_2) in some Pedons of both locations and marginally low (S_3) for some Pedons as well. Available P were marginally low (S_2) for both location Ca, K^+ and Na^{2+} were moderately suitable for both locations (S_3). Magnesium was highly suitable (S_1) in both locations. All the soil Pedons were highly suitable (S_1) with regards to salinity and sodicity status. Oluwatosin (2005) reported that soil fertility is the major limitation to the suitability of Nigerian soils. The low levels of organic content, N and P of the soil are characteristics of the Guinea savannah and mineralization of organic matter and burning of crop residues by farmers as poor management practice.

Table 3:Factors of land Requirement for Wetland Rice

Land qualities	Land characteristics	Unit	S_1	S_2	S_3	N_1	N_2
		%	100-85	84-60	59-40	39-20	19-0
Factors Rating	Annual rain	Mm	>1400	1200-1400	950-1100	850-900	<850
Climate(c)	Solar radiation	Cal.cm-^{2} day-^{1}	>300	300-200	200-100	<100	Any
Growing period	LPG+	Days	120-180	70-120	>70	<70	Any
Soil Physical	Soil Depth	Cm	>20	10-20	5-10	<5	Any
Characteristics	Clay	%	40-25	25-15	15-5	≤15;≥5	Any
Wetness(w)4	Drainage	-	1-3	1-3	3	Any	Any
	S.W.D	Cm	10-20	20-40	40-60	>60	Any
	F.D	Months	<4	3-4	2-3	>2;>4	Any
	G.W.T	Cm	0-15	15-30	30-60	>60	Any
Fertility Status(f)	pH	-	5.5-7.5	5.2-5.5	≤5.2;≤8.2	≤5.2;8.2	Any
	Total N	%	>0.2	0.1-0.2	0.05-0.1	<0.05	Any
	Organic carbon	%	2.3	1-2	3.4	>4;<1	Any
	P(Bray)	Mg-Kg-1	>20	15-20	10-15	<10	Any
	P(Olsen)	Mg-Kg-1	>10	7.5-10	5-7.5	<5	Any
	K	Cmol.kg-1	>0.2	0.1-0.2	<0.1	<0.1	Any
	Ca	Cmol.kg-1	10-15	5-10	1-5	<1;>5	Any
	Mg	Cmol.kg-1	2-5	1-2	<1	<1;>5	Any
	CEC (soil)		>16	10-16	5-10	<5	Any
Toxicity(t)	Active-Fe	%	<0.75	0.75-1.0	1-1.25	>1.25	Any

Table 4: Suitability Class Scores of the Profiles in the Study Area for Wetland Rice Production (Gidan Tindi and Jangwa)

S/No	Land quality and characteristics	Profile I,II	Profile II1,IV	Profile V,VI	Profile VII,VIII	Profile IX,X	Profile IX,XII
1	Climate(c); Annual rainfall (mm)	S2(84)	S2(84)	S2(84)	S2(84)	S2(84)	S2(84)
2	Growing period PG+(days)	S1(85)	S1(85)	S1(100)	S1(100)	S1(85)	S1(85)
3	Soil physical characteristics soil depth (cm) Clay (%)	S1 (100) S2 (84)	S1 (100) S1 (95)	S1 (100) S1 (95)	S1 (100) S1 (95)	S1 (100) S1 (95)	S1 (100) S1 (95)
4	Wetness (w); Drainage	S3(59)	S3(59)	S1(95)	S1(98)	S1(95)	S1(95)
5	pH	S1(100)	S1(100)	S2(84)	`S2(84)	S1(95)	S1(5)
6	Total N (%)	S3(40)	S3(40)	S3(40)	S3(40)	S3(40)	S3(40)
7	Organic carbon (%)	S2(84)	S2(84)	S1(85)	S1(85)	S2(80)	S2(80)
8	P(Bray) mg.kg-1)	N1(20)	N1(20)	N1(20)	N1(20)	N1(20)	N1(20)
9	K(cmolkg-1)	S1 (95)	S1 (95)	S1 (95)	S1 (95)	S1 (90)	S1 (90)
10	Ca (cmolgk-1)	S3(40)	S3(40)	S3(40)	S3(40)	S3(40)	S3(40)
11	Mg(cmolgk-1)	S2(84)	S2(84)	S2(84)	S2(84)	S2(84)	S2(84)
12	CEC (soil) (cmolgk-1)	S3(40)	S3(40)	S3(40)	S3(40)	S3(40)	S3(40)
13	Mean value	49	95	95	95	84	84
14	Aggregate suitability class	S3	S3	S1	S1	S2	S2
15	Limited characteristics	d,n	d,n	N	N	N	N

Aggregate suitability class scores: 100-75=S1, 74-50=52, 49-25=S3, 24-0=N1 Note: Profiles I – VI (Gidan Tindi) Profiles VII – XII (Jangwa)

Table 5: Actual Suitability of the Flood Levels/Topographic Position

Flood Level	Profile	Actual Suitability class
Gidan Tindi		
Levee	1,2	S_1
Medium	3,4	S_1
Toeslope	5,6	S_1
Jangwa		
Levee	7,8	S_1
Medium	9,10	S_1
Toeslope	11,12	S_1

CONCLUSION AND RECOMMENDATIONS

The objective of this research was to evaluate the suitability of the flood plain soils of Awe, southern guinea savannah zone of Nigeria for rice production with the aim to establishing best management practices for increased rice production. From the research findings, the suitability rating of flood plain soils of the study area indicated a highly suitable (S1) in all the profiles for rice production. The research findings also indicated that most soil suitability parameters evaluated are within the threshold of soil fertility standards for normal rice production. Management practices such as organic matter incorporation, liming to increase soil pH, fertilizer application and appropriate time of planting are hereby recommended for increased rice production in the mapping units that are not highly suitable for rice production in the study area

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