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AN EVALUATION OF SOIL SUITABILITY FOR MAIZE PRODUCTION IN OBIARUKU COMMUNITY IN NIGERIA

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ABSTRACT

The goal of the study was to assess the suitability of two prominent land parcels for maize production in the Obiaruku Community of Delta State of Nigeria. Specifically, the study assessed soil suitability for maize production by comparing the properties of well-drained soil with those of riverine soil. The quadrat approach was used to collect soil samples from 10 randomly selected plots of 25m^2. Suitability classes of the two prominent soil facets in the area were determined using Olutatosin's (2005) suitability classes of soil required for maize production. The results show that the well-drained soil though sandy in texture, was classified as highly suitable for maize production due to its high level of essential soil nutrients; whereas, the soil of the riverine area was classified as moderately suitable for maize production due to its medium level of soil chemical nutrients. However, in order, to achieve long-term sustainable production of maize mostly in the highly suitable area, good soil conservation practices such as mulching to avoid the damaging effects of soil erosion and good farming systems such as bush fallowing, continuous addition of dead decaying litter from leaf fall as well as the adoption of vegetated buffer zones were suggested to conserve soil nutrient for improved maize production.

Keywords: Soil Evaluation, Grain Production, Soil Management.

1. INTRODUCTION

Maize (*Zea mays L*) has assumed prominence as a food crop and a source of carbohydrate for several centuries. Maize is thus, one of the main crops grown by small holder farmers in Nigeria. However, yields are often very low partly due to the inadequate supply of nutrients as a result of declining soil fertility (Ramaru *et al.*, 2000). Maize has been a major food and source of livelihood for the majority of Nigerians for centuries. It started as a subsistence crop and has gradually risen to the status of a commercial crop on which many agro-based industries depend on as a raw material. Virtually all tribes in Nigeria consume maize, either fresh or processed. Maize is therefore a tropical grass that is well adapted to many climates and hence has wide-ranging maturities from 70 days to 210 days. The optimum temperature for maize growth and development is 18 to 32 °C, with temperatures of 35 °C and above considered inhibitory. The optimum soil temperatures for germination and early seedling growth are 12°C or greater, while 21 to 30 °C is ideal for sustained growth. Maize can grow and yield with as little as 300 mm rainfall, but prefers 500 to 1200mm as the optimal range. Nevertheless, depending on soil type and stored soil moisture, crop failure would be expected if less than 300 mm of rain is received.

However, farmers in Obiaruku Community based on indigenous knowledge are conversant with the climatic and edaphic requirements for the cultivation of crops, but unfortunately, they lack empirical knowledge on the exact soil facet that favours optimum production of maize mostly in the face of declining and fertile farmlands. The decline in farmland is attributed to residential expansion the area has witnessed over the past two decades. This phenomenon has resulted in the reduction of fertile farmlands which are usually found in the hinterland, due to the reduction in farmland, maize as well as other cereal and tuber crops is usually grown on riverine soils, which in most cases are inundated during periods of extreme rainstorms. The suitability evaluation of these land facets for improved productivity has little been investigated. Land suitability assessment for agriculture is meant to evaluate the potentials of a piece of land to provide the optimal ecological requirements of a certain crop variety. In other words, assessing the capability of land is enabling optimum crop development and maximum productivity. Thus evaluation needs a specification of the respective crop requirements and calibrating them with the terrain and soil parameters (Dent and Young, 1981). The identified limiting factors could be managed to suit the various crop requirements and improve crop productivity. This is a pre-requisite to productivity maximization in the agricultural sector. As optimal crop growth and productivity is based amongst other factors on soil conditions, the climate and agricultural practices (Ande *et al.,* 2011).

However, the increasing demand for land for agricultural production requires that decisions be made in the most beneficial use of limited land resources, whilst at the same time conserving these resources for the future (Dent and Young, 1981). The function of land evaluation on this note is to bring about an understanding of the relationships between the condition of the land and the uses to which it is put into, and to present planners with comparisons and promising alternative options. In Obiaruku Community, the destruction of the natural habitat (forest) mostly for residential and infrastructural expansion has resulted in the dwindling of farmlands suitable for farming activities. Based on this land shortage, farmers in the area are left with no choice but, to cultivate crops around riverine areas. The need for a sustainable increase in maize production per unit area in Nigeria has resulted in more soil being opened up for large scale maize production (Ande *et al*., 2008) coupled with the dwindling nature of farmlands caused by increased infrastructural development. Indeed, adequate information on the land resources and their capability to support crop production is perhaps the starting point toward sustainable soil management and food security.

In the views of Esu (2004), studying soil in details through the processes of soil characterization and land evaluation for various land utilization types is one of the strategies for achieving food security as well as sustainable environment. However, despite the importance of land evaluation on the sustainable management of land and for enhanced crop production, specific soil suitability studies such suitability assessment for maize production have not been properly documented in the literature; and available ones show locations and ecological bias (Gbadegesin, 1984; Adetunji, 1991; Oluwatosin, 2005). More so, some of the studies available provide holistic approaches on land evaluation and are not crop specific (FAO, 1976: 1983: 1995; Dent and Young, 1981; Rossiter, 1994; George, 1997; Adeleye, 2002; USDA, 2003). This study attempts to contribute to existing knowledge as well as fill the locational gap in knowledge on soil suitability assessment for maize production in Obiaruku by: (i) evaluating the physical and chemical properties of well-drained and riverine soils in the area, and (ii) comparing their suitability for maize production in comparison with Oluwatosin's (2005) reported requirements for maize production.

2. LITERATURE REVIEW

At whatever scale (e.g. local, national, regional and even global), land evaluation can be carried to understand land potentials for a particular purpose. According to George (1997), studies at the national scale may be useful in setting national priorities for development, whereas those targeted at the local level are useful for selecting specific projects for implementation. Land evaluation is applicable both in areas where there is strong competition between existing land uses in highly populated zones as well as in zones that are largely undeveloped. FAO (1978) noted that for assessing the suitability of soils for crop production, soil requirements of crops must be known. Also, these requirements must be understood within the context of limitations imposed by land form and other features which do not form a part of the soil but may have a significant influence on use that can be made of the soil. From the basic soil requirements of crops, a number of soil characteristics are directly related to crop yield performance. Beyond critical ranges, crops cannot be expected to yield satisfactorily unless special precautionary management measures are taken. Soil suitability classifications are therefore based on knowledge of crop requirements, of prevailing soil conditions and of applied soil management. In other words, soil suitability classifications quantify in broad terms to what extent soil conditions match crop requirements under defined input and management circumstances (FAO, 1976).

Earlier studies on land evaluation underscore its importance in assessing the potentials of land for a specific purpose as well as understanding its optimal requirement. For example, Gbadegesin (1984) examined soils classification of the central savanna zone for maize cultivation. The soil requirements for maize cultivation were collated and the soil conditions in the respective areas were marched with soil requirement for maize production. He used a classification technique which rates the soil of each area on different classes that are suitable for maize production. In the study, soil was the main focus and classes were established on the ratings accorded to each area. Ogunwale *et al.,* (2009) evaluated the suitability of University of Ilorin farmland in the Southern Guinea Savanna ecological zone of Nigeria for cowpea. Five soil series were mapped out and were subjected to morphological, physical and chemical analysis. Their suitability classification shows that Bolorunduro series (unit), which covers about 32%, is the most suitable for cowpea cultivation. They also found out that the topography is not a constraint to the production of cowpea in Ilorin and environ. In another study, Ljusa and Pajovic (2002) investigated the land suitability for rain- fed agriculture in the province of Larache, Morocco. The study area was characterized by crops which were separated into three groups as food crops (maize, sugarcane, chickpea, potato, tomato, green, pepper, onion, sunflower and wheat), fodder crops (barley, sorghum and alfalfa) and tree crops (citrus and olives), all with different agricultural management. They found out that crops like chickpea, tomato, green pepper, onion, sorghum and alfalfa belong to the group of crops which are not recommended for rain- fed agriculture.

Furthermore, Francesco (2003) carried out land evaluation of Thies Region, Senegal, for maize. The evaluation showed that the northern part of the region contained suitable lands for maize while in northwest part along the shoreline, the crop-lands were unsuitable, which was due to the domination of sandy soils. Otomi (2010) evaluated land use along the course of

River Ethiope in Abraka, Delta State. The study emphasized the suitability of the farmlands across the bank of the river for some crops like maize, okra and other vegetable crops. She maintained that the suitability of the lands for those crops was due to the availability of water in the soil. Agbogidi *et al.,* (2007) in a study carried out at the Research farm of the Delta State University, Asaba campus and the Delta State College of Agriculture Research Farm, Ozoro. The study demonstrated that soil contamination with crude oil has a highly significant effect of reducing some mineral element composition of maize. Their result shows that the suitability of the soil for maize production is minimized as a result of the contamination. They also maintained that their result could provide a basis for future work by plant breeders who are searching for means of boosting maize production in the oil producing areas of the Niger Delta region.

Dunshan *et al.,* (2006) studied land suitability for agricultural crops in Danling County-Sichuan province, China. Several crops were analyzed; in particular, the suitability for rice was compared to the one for other summer crops like sweet potato and maize. A comparison between wheat and rape (*Brassica napus*) was carried out since these are the more common crops to be rotated with rice. Al-Areba *et al.,* (2007) evaluated land suitability for key agricultural crops in Essaouira Province, Morocco. The principal crops cultivated in the area were barley, maize, onion, and wheat which are the main source of subsistence for the families in Essaouira. They also recommended results and solutions to the local stakeholders for an increase in yield. Suitability maps were produced for each specific crop. In general, the evaluation class for the crops suitability ranges from moderately suitable to permanently not suitable. This is due to the different condition that the crops require for their developments in the local area in question. Barley and wheat were the most important crops for the economy and subsistence of the families in the region since most families earned their livelihoods from the cultivation of these crops.

The review of existing literature shows that land suitability assessment for agriculture is meant to evaluate the ability of a piece of land to provide the optimal ecological requirements of a certain crop variety. Perhaps, assessing the capability of land is enabling optimum crop development and maximum productivity. Thus evaluation needs a specification of the respective crop requirements and calibrating them with the terrain and soil parameters. According to Dent and Young (1981), optimal crop growth and productivity is based amongst other factors on soil conditions, the climate and agricultural practices. They posited that cation exchange capacity; soil organic matter content expressed by the organic carbon content; soil depth and stoniness are amongst the main factors that influence crop adaptability to a given land area. It is also obvious that most studies on land evaluation were carried out at national or regional scales (see Gbadegesin, (1984), Francesco, (2003), Ljusa and Pajovic, (2002), neglecting the local scale. Apart from Ogunwale *et al.*, (2009), studies on land evaluation at a local scale have not been extensive. It is in the context of this neglect that this study intends to fill.

3. MATERIALS AND METHODS

3.1 STUDY AREA

This study is carried out in Obiaruku, the headquarters of Ukwuani Local Government Area of Delta State between the 5^{th} and 7^{th} of June, 2011. Obiaruku lies between latitude $05°48^1$ and $06° 32^1$ north and longitude $06°06^1$ and $06°26^1$ east. It is a well grown town extending 18 kilometers north of the River Ethiope (Fig. 1). The area falls within the tropical environment that enjoys the tropical rain forest climate. The temperature is high for most part of the year with a range of 25°C - 28°C and an annual range of temperature that varies between 3°C - 5°C.

Annual rainfall varies from 2000mm – 2700mm. The area is underlain by the Benin formation of coastal plain sands. Obiaruku is drained by river Ethiope, which took its source from Umuaja and flows westwards into the Atlantic Ocean (Efe, 1994). It has its main tributaries, the river Orogodo joining it at abraka and the lower Jamissons River joining it at Sapele. Other tributaries joining the river are seasonal. The river basin is bounded in the north by the Benin basin, on the east by the River Niger basin and at the south by the Warri river basin. Based on the classification of rocks in Nigeria by Akintola (1982), the area falls within the recent Holocene sedimentary belt. The area is characterized by sandy soils, whitish in color especially at the upper layers and along the bank of river Ethiope, grey and dark in the seasonally and permanently flooded portions due to the accumulation of raw organic materials on the surface. Based on this study, the area is characterized by two major types of soils- the Riverine and the well drained Soils (Fig. 2). Agriculture remains the major occupation of the people, growing crops like maize, cassava, yam, plantain, melon, okra among others. Maize remains the major food crop grown in the area.

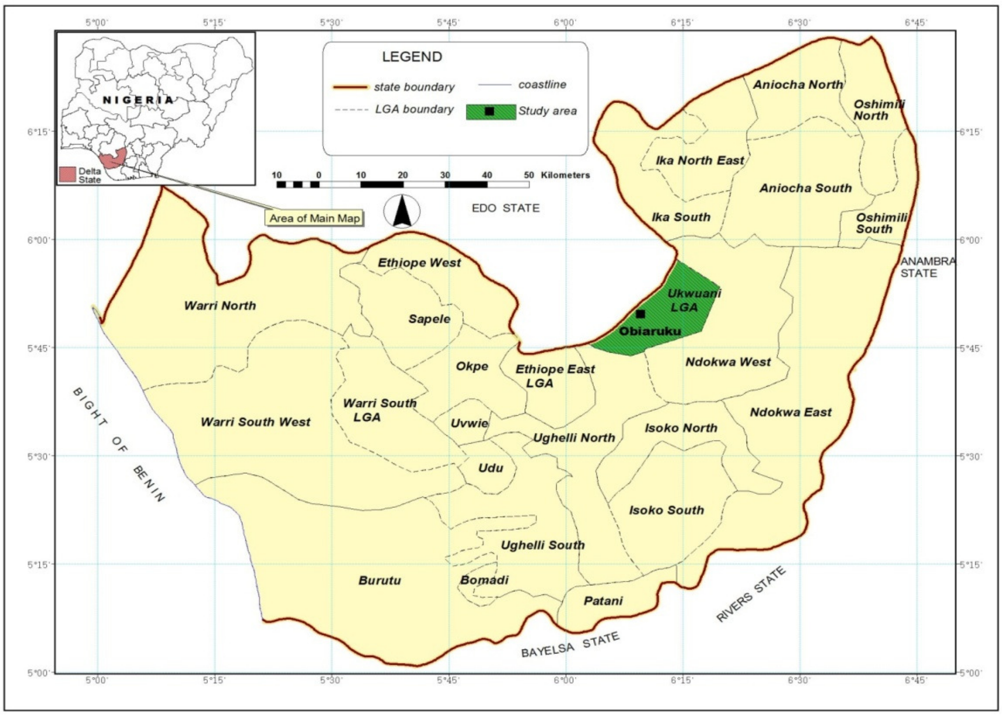

Fig. 1: Delta State showing Obiaruku

3.2 SAMPLING PROCEDURE

The study assessed soil suitability for maize production by comparing the properties of well-drained soil with those of riverine soil. Both soil facets (i.e. well-drained and riverine soils) are characterized by sandy soils, whitish in colour. The well-drained soil is dominated by trees and grasses, while the riverine area has less trees, but more of grasses. In each soil facet or community, a line transect of 60m was established, from which soil samples were randomly collected from 10 plots of 5m x 5m out of the 12 laid. In each plot, 5 surface (0-10 cm) soil samples were randomly collected with a soil auger and then composited. The soils were put in polythene bags with labels; they were thereafter air-dried and taken to the laboratory at the

Department of Agronomy, University of Ibadan, Ibadan for analysis of soil physical and chemical properties. Soil organic carbon was determined by the method of Walkley & Black (1934), after which values obtained were multiplied by 1.724 (Aweto, 1981) to convert to organic matter; total nitrogen by the Kjeldahl method (Bremner & Mulvaney 1982) and available phosphorus was determined by the method of Bray & Kurtz (1945). The soils were leached with 1M neutral ammonium acetate to obtain leachates used to determine exchangeable bases and soil cation exchange capacity, while pH values were determined using a glass electrode testronic digital pH meter with a soil: water ratio of 1:2. Soil particle size composition was analysed using the hydrometer method (Bouyoucos 1926). Furthermore, since the climatic conditions of the area are ideal for maize production, emphasis for this study was placed on the soil requirements of the two dominant soil facets (well-drained soil and riverine soil) to sustain long-term maize production.

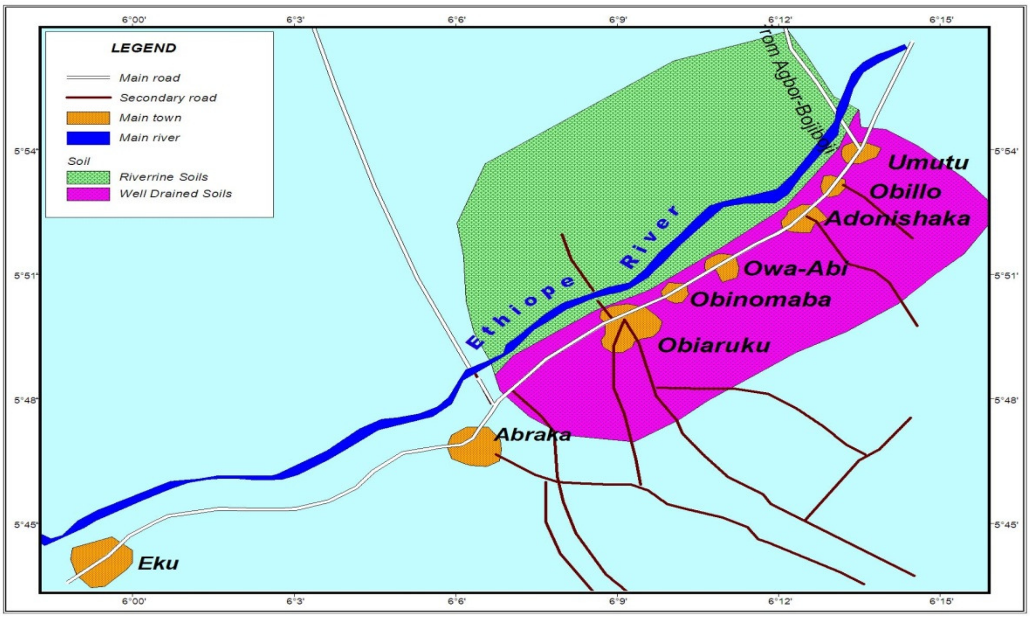

Fig. 2: Showing the Well-drained and Riverine soil

3.3 DATA ANALYSIS

Data obtained from the procedures above were analysed using both descriptive and inferential statistical techniques. Descriptive techniques such as tables, simple percentages and averages were used to represent the data for easy comparison, while inferential tool basically independent samples test was used to determine if significant differences exist in the two soil facets. In addition, in order to determine the suitability classes (highly or moderately suitable for maize production), soil properties of the soil facets were statistically compared using independent samples test with Olutatosin's (2005) suitability classes of soil requirement for maize production.

4. RESULTS AND DISCUSSIONS

4.1 PHYSICAL PROPERTIES OF SOIL

Table 1 shows information on the particle size distribution of well-drained and riverine soils. Result showed that the amount of sand was relatively higher in the riverine soil than in well-drained soil with mean values of 92.3% and 89% respectively. Invariably, the higher level of sand in the riverine soil implies that it is low in both organic matter and clay, and aggregation is weak. This according to Ukpong (1994) may impair firm establishment of flora species. However, sand content differs between the soils ($p<0.05$). The concentration of silt was substantially higher in well-drained soil than in riverine soil with mean values of 5.2% and 4.2% respectively. There was however no significant difference in the proportion of silt content in the two soils ($p>0.05$). Silt, because of its smaller particle size, is known to have a slower water intake, but a higher water holding capacity than sandy soils.

Silt, according to Ukpong (1994) is a physical site quality associated with nutrient availability, mostly CEC and organic carbon. In addition, the amount of clay happened to be higher in well-drained soil than in the riverine soil with mean values of 5.4% and 3.6% respectively. The content of clay differed significantly between the two soils ($p<0.05$). Clay is involved in almost every reaction in soils which affects plant growth. According to Page (1963) both chemical and physical properties of soils are controlled to a very large degree by properties of clay. Clay is the active part of the soil both chemically and physically. The importance of clay on the availability of nutrients in the soil has been noted by scholars, for example, Aweto (1981) notes that the proportion of clay in the soil strongly affects tree regeneration since clay enhances soil water-retaining and nutrient-holding capacities. In all, the soils were predominantly sandy with sand in both soils accounting for more than 80% of the inorganic mineral fragments (Aweto and Dikinya, 2003).

Table 1: Summary of physical parameters of the soil samples[a]

Parameters	Soil facets		t - Value
	Well-drained soil	Riverine soil	
Sand (%)	89±0.47	92.3±0.53	4.693*
Silt (%)	5.2±0.55	4.2±0.61	1.213NS
Clay (%)	5.4±0.42	3.6±0.63	2.377*

[a]Values are means ± standard errors. *Difference between means is significant at 5% alpha level NS: Difference between means is not significant at 5% alpha level.

4.2 CHEMICAL PROPERTIES OF SOIL

Information on the chemical properties of well-drained and riverine soils is depicted in table 2. The proportion of organic matter (OM) was to a large extent higher in well-drained soil than that in the riverine soil, with mean values of 0.72% and 0.33% respectively. Significant difference existed in the proportion of OM between the sampled soils ($p<0.05$). High amounts of OM in the soil are known to improve soil quality which in the long-run encourages plant growth. Nitrogen is one of the most important plant nutrients and forms some of the most mobile compounds in the soil crop system and as such is commonly related to water quality problems (Soil Survey/Investigation Report, 1995). The proportion of total nitrogen (N) was considerably higher in well-drained soil than that in the riverine soil, with mean values of 0.18% and 0.09% respectively. This implies that the well-drained soil has high availability of N than riverine soil (table 2), and its content differed significantly ($p<0.05$). Like OC, high amount of N in the soil helps to improve soil quality which in the long-run encourages plant growth and agricultural productivity and sustainability.

Table 2 showed that the mean concentration of available phosphorus was considerably higher in well-drained soil than in riverine soil with values of 23.05 ppm and 18.19 ppm respectively. This perhaps indicates that the well-drained soil is richer in Av. P than the riverine soil; precisely, Av. P is high in both soils. The increase in available phosphorus in both soils may have been borne out of the fact that the accumulation and subsequent decomposition of litter resulted in a moderate rise in pH, which may have enhanced the availability of phosphorus (Ayodele and Agboola, 1981). There was however no significant difference in the proportion of Av. P between the two soils ($p>0.05$). The mean CEC value in well-drained soil was relatively higher than that in the riverine soil with values of 4.74meq/100g and 3.64meq/100g respectively. The level of CEC in both soils showed significant difference existed between the soil ($p<0.05$). This variation may be attributed to the higher amount of organic matter (as the amount of CEC in the soil is determined by organic matter.) in well-drained soil compared to riverine soil where the rate of decomposition is low. A low CEC value means that the soil is unable to hold adequate nutrients thereby limiting the availability of nutrients to plant and micro-organisms.

Table 2: Summary of chemical parameters of the soil samples[a]

Parameters	Soil facets		t - Value
	Well-drained soil	Riverine soil	
OM (%)	1.25±0.21	0.60±0.19	2.288*
TN (%)	0.18±0.03	0.09±0.03	2.099 *
Av. P (ppm)	23.06±3.36	18.19±1.77	1.282 NS
CEC (meq/100g)	4.75±0.34	3.64±0.30	2.426*
Exch. Ca (meq/100g)	1.39±0.25	0.75±0.26	1.780 NS
Exch. Mg (meq/100g)	1.10±0.08	0.85±0.06	2.436*
Exch. K (meq/100g)	0.21±0.07	0.14±0.03	0.890 NS
Exch. Na (meq/100g)	1.69±0.03	1.43±0.04	5.072*
Ph	6.40±0.09	6.25±0.16	0.821 NS
B. Sat. (%)	92.18±1.01	85.99±1.46	3.480*
Soil moisture (%)	0.99±0.21	1.03±0.25	0.136 NS

[a]Values are means ± standard errors.
*Difference between means is significant at 5% alpha level
NS: Difference between means is insignificant at 5% alpha level.

CEC is therefore an important property of soil because it is a useful indicator of soil fertility, nutrient retention capacity and the capacity to protect groundwater from cation contamination (Molloy, 2007). Comparatively, the well-drained soil is more fertile than the riverine soil. Furthermore, information on the contents of exchangeable bases is shown in table 2. Exchangeable bases according to Brix (2008) are important properties of soil and sediments as they relate information on a soil's ability to sustain plant growth, retain nutrients, buffer acid deposition or sequester toxic heavy metals. The proportions of exchangeable calcium (Ca), exchangeable potassium (K) and exchangeable magnesium (Mg) were appreciably higher in well-drained soil than in riverine soil. The very low concentration of Ca, K and Mg in the riverine soil implies the soil is of poor quality. Furthermore, the proportion of exchangeable sodium (Na) was higher in well-drained soil than in riverine soil with mean values of 1.69meq/100g and 1.43meq/100g respectively. There was significant difference in the proportion of Na in the two soils ($p<0.05$), though Na is often considered (Aweto and Dikinya, 2003) as a non-essential element for most plants.

Information on base saturation of the soils is depicted in table 2. Base saturation according to Reid (2004) is the proportion of the cation exchange sites in the soil that are occupied by the various cations (hydrogen, calcium, magnesium, potassium). The table (2) showed that the proportion of base saturation was appreciably higher in well-drained soil than in the riverine soil with mean values of 92.17% and 85.90% respectively. The content of base saturation differed significantly in the two soils ($p<0.05$). The high proportion of B.Sat in the well-drained implies that the soil has high amounts of exchangeable bases necessary for crop growth. In addition, soil moisture which is the water held in pores in the soil in liquid and vapour phases, is slightly more in riverine soil than in the well-drained soil with mean values of 1.03% and 0.99% respectively. There was no significant difference in the proportion of moisture in the two soils ($p>0.05$).

Excess soil moisture according to Mweso (2003) can lower soil oxygen levels which in turn decrease the respiration rate for the plants root system and thus lower potassium uptake. Also, excess water can increase the amount of leaching of potassium, particularly in sandy soils. This therefore implies that the well-drained soil is ideal for crop production due to the appropriate level of moisture in the soil that does not inhibit oxygen availability. Nevertheless, the soils in the area were slightly acidic with mean pH values of 6.4 and 6.3 for well drained soil and riverine soil respectively. The pH was slightly higher in well drained soil than in riverine soil, this slight increase was however not significant ($p>0.05$). The high pH observed in both soils of above 6 and below 7 has substantial effects on nutrient availability in the soil (Osemwota, 2010). This level of pH according to Brady and Weil (2005) is the range of maximum nutrient availability in the soil; hence this level of pH in both soils is adequate for the decomposition of organic matter thereby increasing the availability of phosphorus, manganese and calcium in the soil[1].

4.3 COMPARATIVE ANALYSIS OF SUITABILITY CLASSES OF SOIL PROPERTIES

We selected the soil properties of well-drained and riverine soils were assessed for suitability by comparing their vales with Oluwatosin's (2005) suitability classes of soil requirement for maize production, the essence therefore was to situate the analysed soil properties of the two soil facets between the classes outlined by Oluwatosin (table 3) .i.e. highly and moderately suitable classes. Result in the table (table 3) indicated that the proportions of N in well-drained and riverine soils were above Oluwatosin's minimum and maximum limits for highly suitable classes. The proportion of available phosphorus (P) indicated that soils in the riverine area were within the maximum limit of soil requirement for highly suitable (S1) soils, while soils in the well-drained soils were above the suggested maximum limit for highly suitable (S1) soil. In addition, the levels of potassium, pH and CEC in both soils were within Oluwatosin's highly suitable limits for maize production.

Furthermore, the proportions of base saturation in both soil facets were above the suggested limits of 50% – 80%; while the levels of organic matter in the riverine soil happened to be below the moderately suitable requirement limit for maize production, but within the required highly suitable limit in the well-drained soil (table 3). This implies that the well-drained soil with the contents of N, P, BS and OM higher than the highly suitable limits was most suitable for maize production than the riverine soil. This decision corroborates similar studies (Andes, 2011; Andes *et al.,* 2008).

[1] See www.dekalb-asia.com

Table 3: Suitability classes of soil properties

Nutrients	S1 (100%)	S2 (85%)	Well-drained soil[a]	Riverine soil[a]
N	0.04 – 0.08	0.04 – 0.02	0.18	0.09
P	13 – 20	6 – 13	23.05	18.19
K	0.3 – 0.5	0.2 – 0.25	0.21	0.14
pH	5.0 – 6.5	6.5 – 7.0	6.4	6.3
CEC	8 – 10	6 – 8	4.74	3.64
BS	50 – 80	45 – 50	91.17	85.90
OM	1 – 2	0.8 – 1.0	1.25	0.60

[a]Values are averages of the respective soil nutrients.
S1 = highly suitable and S2 = moderately suitable as defined by Oluwatosin (2005).

4. CONCLUSION

Though, the well-drained soil was sandy in texture, but its soil properties notably organic matter (1.25%), total nitrogen (0.60%), available phosphorus (23.05 ppm) and base saturation (91.17%) were above the critical requirement limits for highly suitable soil as recommended by Oluwatosin (2005). These high values were nevertheless insignificant when compared with the maize nutrient requirement reported by Oluwatosin. The well-drained soil was therefore classified as highly suitable for maize production due to the high levels of essential nutrients. The riverine soil on the other hand was classified as moderately suitable for maize production due to its medium level of soil chemical nutrients most especially the low proportions of organic matter (0.60%) and total nitrogen (0.09%).

The riverine soil is low in essential nutrients, though this can be improved upon through good management practices. In order, to maintain soil fertility for improved maize production, the maize plant must be supplied with adequate nutrients particularly nitrogen, phosphorus and potassium. The quantity required of these nutrients particularly nitrogen depends on the pre-clearing vegetation, organic matter content, tillage method and light intensity. The nutrient requirement is satisfied by the application of the right form of fertilizer containing the requisite combination of the elements. However, to achieve long-term sustainable production of maize mostly in the highly suitable soil, good soil conservation practices such as mulching to avoid the damaging effects of soil erosion, good farming systems and operations such as bush fallowing, continuous addition of dead decaying litter from leaf fall and the adoption of vegetated buffer zones should be practiced by farmers in the area to conserve soil nutrient for improved agricultural productivity (Andes, 2011; Nair, 1983). Riverine soil though moderately suitable, can act as buffer zones removing nitrate in waters coming from agricultural land before it enters the river where is can damage the natural balance of the ecosystem.

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