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Research Application Summary

Characterisation and capability classification of soils on a coastal plain sand parent material in Akwa Ibom State, Nigeria

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Abstract

Systematic identification and inventory of soil resource, their qualities and proper assessment for sustainable use is a major criterion towards addressing the issue of food security in Nigeria. The objective of this study was to characterise, classify and assess the capability of soils formed on coastal plain sand Obong Ntak in Etim Ekpo Local Government Area of Akwa Ibom State, Nigeria. The soils were classified as Alfisols at the order level, and the capability classification was class I and II, having moderate limitation that restrict their use, and having moderate limitation that reduce the choice of plants or that require moderate conservation practices, respectively. Information from this study will support sustainable land resource management and crop production, thus strengthening the food security initiatives.

Key words: Alfisols, capacity, food security, soil

Résumé

L'identification systématique et l'inventaire des ressources du sol, leurs qualités et l'évaluation appropriée pour une utilisation durable est un critère important en ce qui concerne la question de la sécurité alimentaire au Nigéria. L'objectif de cette étude était de caractériser, de classer et d'évaluer la capacité des sols formés sur le sable de la plaine côtière Obong Ntak à Etim Ekpo région du gouvernement local d'Akwa Ibom, Nigeria. Les sols ont été classés dans l'ordere des Alfisols, et la classification de la capacité était de classe I et II, ayant la limitation modérée qui freinent leur utilisation, et la limitation modérée qui réduise respectivement le choix des plantes ou qui exigent des pratiques de conservation. Les données de cette étude soutiendront la gestion durable des ressources en terres et la production agricole, renforçant ainsi les initiatives de sécurité alimentaire.

Mots clés: Alfisols, capacité, sécurité alimentaire, sol

Background

Nigeria's land masses are facing intensive competitive uses that very often lead to their misuse and degradation (Akamigbo, 1999). This in effect hinders meaningful national development. It is therefore pertinent that for the potentials of agricultural land to be maximised, there is the need to have a good understanding of the different alternative uses that a land can be put to. Land use ought not to be based primarily on the needs and demands of the users, but rather on the understanding of the suitability of such a land for the intended use in order to achieve environmental sustainability. Physical land evaluation is the first step in agricultural planning for sustainable crop production. This evaluation is essential in that it will guide decisions on land utilization in such a way that the resources of the environment are optimally used, resulting in sustainable management (Fasina and Ogunkunle, 1995). Hence the need to provide information on the quality of soil resources is more essential now than before, principally because of the new urge to open up several hectares of land for commercial agriculture (Okusami, 1988; Fasina, 1997). Unguided conversion of agricultural land to non-agricultural land or inappropriate land use systems (policies) will ultimately lead to environmental and socio-economic problems, including poverty and unsustainable use of land resources (Stevenson and Lee, 2001). There is therefore an urgent need for evaluation of agricultural landscapes and associated planning, owing to problems faced in recent years in the form of increasing pressure on agricultural lands from other uses, coupled with increasing demand for agricultural products due to population growth (Saroinsong *et al.*, 2007). The study aimed at determining the soil and land capability class in Obong Ntak in Etim Ekpo Local Government Area of Akwa Ibom State in Nigeria for enhanced sustainable land use.

Study description

The study area was located in Obong Ntak in Etim Ekpo Local Government Area of Akwa Ibom State. Obong Ntak lies within Latitude $4^0$50 and $4^0$58^{0}N and longitude 7^0 10^0 and 7^0 30E. The area is part of the coastal sands of the Niger Delta Basin. The soils are derived from unconsolidated sedimentary deposit of the Miocene-Pleistcene period. The deposit comprise old alluvial sediments of the Niger River. The study area is within the humid tropical zone which is characterized by a dominant rainy seasons and less influence by season. High temperatures, relative humidity and sunshine hours are other features of the climate. The Research Institute of Nigeria (RIN) sub station Akwete is located within the same geographical location. The mean annual rainfall at RRIN station at Akwete (1989-1998) is 2352.23mm in Abak located within the same Isohyet. Rainfall in the area has a bimodal distribution with the higher peak in September and the lesser peak in July.The study area of about 128 hectares is situated in the tropical rainforest zone.

The Grid method of survey was adopted for the field mapping. Traverses were then cut at 200 m intervals along an established baseline and grid points along the traverse were marked at 100 m intervals. Using the soil auger, soil samples were collected at depths of 0-15, 15-3, 30-60 and 60-90 cm at each grid point. The soils were described in terms of colour, texture and consistency. General observation on vegetation, and land use were also made. Profile

pits were dug in identified mapping units and were sampled / studied for their morphology, physical and chemical properties (e.g. soil colour, texture, pH, CEC, OC, Base saturation, etc.). Following the establishment of the mapping units, representative profile pits were characterized and soil samples collected from the genetic horizons for laboratory analysis.

Research application

Four mapping units were identified, and covered 62.5, 31.5, 31.9, and 2.1 ha, respectively of the surveyed area. The soils in Mapping units A, B,and C are generally very deep, well drained and well developed, with with slopes of 1-2%. The colour of the top soils varies from very dark brown to dark yellowish brown, while the subsurface soil is strong brown. The texture is loamy sand in the top soils and sandy clay loam in the sub surface soil. The soils are moderate to low in organic carbon, acidic with pH ranging from 3.30-4.64. Total Nitrogen, and exchangeable potassium are low while exchange acidity and available phosphorus are high. For optimum crop production in these soils, there is a need for Nitrogen (N) and Potassium (K) application. Liming will also be essential for these soils. On the other hand, the soils in Mapping units D, is located in a depression. The soils are well drained deep and well developed. The colour of this soil is very dark brown, (10YR $^{2}/_{2}$) in the topsoil and yellowish brown (10YR $^{5}/_{8}$) at the subsoil. The texture varied from sandy loam at the topsoil to clay at the subsoil. The soil was very acidic with pH of 4.68, organic carbon was moderately high at the topsoil and decreased with depth. Total Nitrogen and exchange acidity were low while available phosphorus was high. Farming system that will keep the slope permanently covered should be practiced to prevent erosion.

The soils were classified using the USDA Soil Taxonomy (1998). Argillic and Kandic horizons were observed. On the basis of argillic horizon and Kandic horizon and base saturation greater than 35%, the pedons were classified as Alfisols. They were further classified as Udalfs based on the udic moisture regime. At the great group level, some of the pedons

Table 1. Classficiation of soils of Nchanobok and Nnambo

Mapping units	Capacity class	Limitations	Recommended use and management
A	I	Soil acidity	Suited for most crops, especially for tree crops such as oil palm, rubber citrus etc. However lime and N.K. fertilizer would be required for optimum yield.
B	I	Soil acidity	Suited for most crops but corrections for acidity and N.K. deficiency should be made.
C	I	Soil acidity	Suited for most crops but corrections for soil acidity and N.K. deficiency should be made.
D	II	Depression and soil acidity	Suited for most crops. Management practice that would cover the soil should be put in place to avoid erosion

were classified as Kandidalfs on the basis of ECEC less than 12 cmol kg^{-1} in the argillic/ kandic horizon, absence of lithic or paralithic contact within 150cm and clay distribution that does not decrease from the maximum by 20% within 150 cm from the soil surface. At the sub-group level, all the mapping units were classified as Typic Kanhapludalf.

Based on the above soil capacity classes, the soils of Nchanobok and Nnambo were classified as shown in Table 1.

Recommendation

The results of this study should be used for land use planning, policy formulation, maintenance and monitoring of land resources. It is recommended that organic matter (e.g. poultry droppings, crop residues, etc) be combined with lime to improve the soil pH and organic carbon content of the soil.

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