LAND SUITABILITY EVALUATION FOR AFRICAN PEAR (*Dacryodes species*) CULTIVATION ON SOME SOILS IN IGUZAMA COMMUNITY OF EDO STATE.

BY

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BENIN CITY.

OCTOBER , 2023

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A WORK PROJECT SUBMITED TO THE ,DEPARTMENT OF SOIL SCIENCE AND LAND MANAGEMENT, FACULTY OF AGRICULTURE, UNIVERSITY OF BENIN, BENIN CITY IN PARTIAL FUFILMENT OF THE REQUIREMENT FOR THE AWARD OF BACHELOR OF AGRICULTURE DEGREE (SOIL SCIENRCE) OF UNIVERSITY OF BENIN, BENIN CITY, EDO STATE, NIGERIA.

SEPTEMBER , 2023

CERTIFICATION

This is to certify that this project work was carried out by **Emeka Philip OGILI** in the Department of Soil Science and Land Management, Faculty of Agriculture, University of Benin, Benin City, Edo State, Nigeria.

Dr. Miss FAITH OKUNSEBOR Date
Projector Supervisor

DR. Mrs.A.O. BAKARE Date
Head of Department

DEDICATION

This project is specially dedicated to God Almighty my creator, my beginning and the end, my strong pillar, my source of inspiration, wisdom, knowledge and understanding. He has been the source of my strength throughout this program and on his wings only have I soared. I also dedicate this work to all who supported me through the years; those who has encouraged me all the way and those whose encouragement makes me give all it takes to finish that which I have started. Thank you all. My love for you all can never be quantified. God bless you.

ACKNOWLEDGEMENT

My deepest gratitude goes to God who has all that was needed to complete this project and the program. There was never lack or want throughout this study. He took care of everything that would have stopped me in my tracks and strengthened me even through my most difficult times. Blessed be GOD. Thank you Lord

I want to acknowledge the Head of Department, soil science and land Management, Dr Mrs. Bakare A. O, the Dean of the faculty of agriculture, Prof. Orhue E. R and all the lecturers and staff of the department of Soil Science and Land Management, Faculty of Agriculture, University of Benin for the numerous and various support. Thank you all.

My sincere appreciation also goes to my supervisor Dr. (Miss) Faith Okunsebor one of the simplest Lecturer i have met and a true definition of kindness and humility whose contribution and constructive criticism has pushed me to expend the kind of efforts I have exerted on this work. Thank you for your patience, support, direction and understanding. I will never forget you Ma. I also Appreciate my fellow coursemate for your support during the work.

I am and will be forever grateful to Mr. Raphael Toochukwu Nwankwo (My Boss & Brother) ,Miss Ann Odiodion, Mrs. Nwanneka igbo-Ogili(Auntie),Mr Chinweike Ogili , guardian, and my farther, Mr M. J Ogili and his lovely wife Mrs N Ogili. I appreciate all you did for me, my life would not have been the same without your support. Thank you for giving everything possible to achieve this success. To Rev Fr. Chukwuemeka Akabueze CSSP for his possible support to make sure I achive this work, thanks for your prayers. Again To my loving Parent Mr & Mrs M. J OGILI, who has continually prayed for my success, you are one in millions; I cant't find the words to express my gratitude.

Finally, I appreciate all my friends, project mates (Bridget,Mary,Rita,Ifunanya), course mates and well wishers, thanks for being there.

TABLE OF CONTENTS

LIST OF TABELS

LIST OF FIGURES

ABSTRACT

This study was carefullycarried out in Iguzama commity in Ovia North East Local Government. Area of Edo State, to evaluate some soils for African Native Pear cultivation. Soil survey process was carried out on the site using the rigid grid method at a detailed scale. The survey produced four mapping units and each represented with a pedon. Soil samples were collected from each of the pedon for analysis in the laboratory using standard procedures.

Soil survey process was carried out by the grid method at a detailed scale which produced four (4) mapping units. Each mapping units was represented by a pedon and each pedon was appropriately described according to FAO (1976). Soil samples were analysed using standard procedures. Result in all the Pedons shows that mean value for Sand ranges from 787.00-924.00, while Silt ranges from 15.00-44.00 and Clay ranges from 88.00-190.00. Mean value for pH ranges from 5.24-6.38. Sand recorded low variation in all the pedons with cv values ranging from 5.10 to 91.50%; Silt ranges from 8.37 to 54.20% and clay ranges 32.20 to 95.70%. Results of Suitability evaluation showed that pedons 1A and 2A representing an area 3.3 hectares and amounting to 55 % of the land area were marginally suitabale (S3) for African Native Pear cultivation with limitation in climate as a result of rainfall and length of growing season while pedons 1B and 2B representing an area of 3.3 hectares and amounting to 55 % were moderately suitable for African Native Pear cultivation with limitation in soil fertility as a result of the pH of the soils.Thus, the cultivation of African Native Pear in the study area could be profitable after amelioration, it is therefore recommended that the land should be adequately maximized for African Pear cultivaton since the risk of failure is at minimal level.

CHAPTER ONE

1.0 INTRODUCTION

Land evaluation is the process of assessment of land performance when used for specific purposes in order to identify and compare promising kinds of land use. Essentially it is a procedure for comparing land with land use, where land refers to all the factors of the physical environment, including climate, land forms, soils and vegetation. More precisely, land evaluation involves comparison between the environmental requirements of various kinds of land use and the properties possessed by different areas of land.It is also a process for matching the characteristics of land resources for certain uses using a scientifically standardized technique. The results can be used as a guide by land users and planners to identify alternative land uses. Land suitability is the fitness of a given type of land for a specific kind of land use (FAO,1976),or the degree to which it satisfies the land user, which in analogy is the degree of fitness of a given type of cropland for production of a crop species. Land suitability could be assessed for present (Actual Land Suitability) or after improvement (Potential Land Suitability) condition.

Land suitability evaluation provides geospatial information about growing crops where they are best suited and can play a crucial role in addressing contemporary challenges, coping with climate change, and enabling sustainable production. It can also contribute to agricultural land use optimization, as it is used to determine the most appropriate spatial plan for current and future land uses and constitutes a useful tool to achieve sustainable use of the available resources and limit land degradation. Land evaluation also answer a number of questions on how the land is presently managed, and possible improvement to enhance future productivity as well as

economic viability of the land. The evaluation process does not in itself determine the land use changes that are to be carried out, but provides data on the basis of which such decisions can be taken.

Mango (Mangifera indica L.), belonging to the Anacardiaceae family, is indigenous to north-east India and north Burma, but now grown in over 90 countries (Singh et al.,2013). It is one of the most vital fruits in both producing and consuming countries due to its characteristic flavor, taste, and nutritional aspects (Tharanathan et al., 2006; Ntsoane et al., 2019). Mango is a rich source of vitamins A, C and D and contains adequate amounts of fiber which is beneficial for numerous gastro intestinal diseases. World mango production was about 50.65 million metric tons (FAOSTATS, 2019; Statista, 2019), occupying an area of over 4.37 million ha, with developing countries accounting for about 98% of total production. According to the Food and Agriculture Organization (FAO) in 2015, Nigeria produced eight hundred and fifty thousand (850,000) tonnes of mango, with Nigeria ranking ninth among these mango-producing countries (Ugese et al.,2012) and Benue state-ranking first (1st) in the league of states that produce mangos in Nigeria (Ubwa et al., 2014). The need for land suitability evaluation is of paramount importance as it provides information to farmers in their choice of crops in order to minimize cost and maximize profit.Hence this study was carried out in Iguzama community to provide the necessary information on the degree of suitability of the land, before any agro-based investment is been carried out on the land.

The objectives of this study were to:

1. Assess the suitability of some soils in Iguzama community for mango cultivation;

2. Determine the areal extent of each suitability class.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 CONCEPT OF LAND EVALUATION

Land evaluation is the process of assessment of land performance when used for specific purposes in order to identify and compare promising kinds of land use. Essentially it is a procedure for comparing land with land use, where land refers to all the factors of the physical environment, including climate, landforms, soils and vegetation. More precisely, land evaluation involves comparison between the environmental requirements of various kinds of land use and the properties possessed by different areas of land. It is the process of estimating the potential of land for alternative kind of use. The Utilities may be of arable farming, livestock production, forestry, catchment protection, recreation, tourism, wild life, conservation, etc.

Conceptually, land evaluation correlates soil survey information, climate, vegetation and other aspects of land with the specific use for which land is evaluated. In this process, the suitability of the land is assessed and classified. In addition it compares economic benefits obtained and the inputs needed on different types of land uses. Evaluation is made in terms of relevance in the physical, economic and social contest of the area concerned. Thus land evaluation is a multi-disciplinary approach.

According to Dent and Young (1981) land evaluation demands information from three sources; land, land use and economics. Data on land can be collected through natural resources surveys, including soil surveys. Information on the ecological and technical requirement of different kinds of land use is obtained from agronomy, forestry and other relevant disciplines. Depending on the

objective of the evaluation, economic data are required. For physical evaluation, the economic needed are concerned broad features of the economic and social context, e.g. general wage levels, the extent of mechanization, size of land holdings etc. But for economic evaluation, the data on specific costs and prices are needed (McRae and Burnham, 1981).

2.2 LAND SUITABILITY EVALUATION

Vink (1975), citing Brinkman and Smith (1973), defines land evaluation of collating and interpreting, basic inventories of soil, vegetation, climate and other aspects of land in order to identify and make a first comparison of promising land use alternatives in simple socio-economic terms Baja et al.(2007) reported two general kinds of land suitability evaluation approaches; qualitative and quantitative. By qualitative approach, it is possible to assess land potential in qualitative terms, such as highly suitable, moderately suitable, or not suitable. In the second approach, quantitative assessment of land suitability is given by numeric indicators.

Operationally, land suitability analysis describes a procedure of land appraisal with a specific land use objective in mind (Corona et al., 2008). More specifically, land suitability evaluation will recommend for growing or not growing a particular crop, in a particular field.

2.2.1 Qualitative analysis

Qualitative land evaluation quantifies the benefit obtained from the land physically. It is usually carried out as a basis for economic evaluation but it is a relatively difficult task. For quantifying benefits, all land parameters are determined (Manikandanet al, 2013).

2.2.2 Quantitative analysis

Quantitative land evaluation quantifies the benefits obtained from the land physically. It is usually carried out as a basis for economic evaluation but it is relatively difficult task. For quantifying benefits, all land parameters are determined.

2.3 LAND SUITABILITY CLASSIFICATION

Land suitability is the fitness of a given type of land for a specific kind of land use (FAO,1976), which in analogy is the degree of fitness of a given type of cropland for production of a crop specie.The land suitability classification, using the guidelines of FAO (1976) is divided into Order, Class, Sub Class, and Unit. Order is the global land suitability group. Land suitability Order is divided into S (Suitable) and N (Not Suitable). Class is the land suitability group within the Order level. Based on the level of detail of the data available, land suitability classification is divided into: (1) For the semi detailed maps (scale 1:25.000-1:50.000) the S order is divided into Highly Suitable (S1), Moderately Suitable (S2), and Marginally Suitable (S3). The "Not Suitable" order does not have further divisions. (2) For reconnaissance level map (scale 1:100.000-1:250.000), the classes are Suitable (S), Conditionally Suitable (CS) and Unsuitable (N). The difference in the number of classes is based on the level of details of the database in each scale.

Class S1 Highly Suitable: Land having no significant limitation or only have minor limitations to sustain a given land utilization type without significant reduction in productivity or benefits and will not require major inputs above acceptable level.

Class S2 Moderately Suitable: Land having limitations which in aggregate are moderately severe for sustained application of the given land utilization type; the limitations will reduce

productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciable compared to that expected from Class S1 land.

Class S3 Marginally Suitable: Land having limitations which in aggregate are severe for sustained application of the given land utilization type and will so reduce productivity or benefits, or increase required inputs, that any expenditure will only be marginally justified.

Class N Not Suitable as the range of inputs required is unjustifiable.

The Subclasses are a more detailed division of classes based on land quality and characteristics (soil properties and other natural conditions).

2.4 AN OVERVIEW OF MANGO

Mango (Mangifera indica L.), belonging to the Anacardiaceae family, is one of the most vital fruit worldwide in both producing and consuming countries due to its characteristic flavor, taste, and nutritional aspects (Tharanathan et al., 2006; Ntsoane et al., 2019).Mangoes are grown in 85 countries and 63 countries provide more than 1000 metric tonnes a year country. Mango is one of the oldest cultivated fruit crops, having been grown in India for at least 4000 years (Litz 2009). Mango is indigenous to north-east India and north Burma, but now grown in over 90 countries (Singh et al. 2013). Mango is the most important fruit crop of Asia and its annual production is exceeded worldwide only by musa, citrus, grapes and apples (Litz 2009). The mango is an erect, branched, medium to large-sized tree with alternately arranged evergreen or nearly evergreen leaves, with a wide crown and inflorescences having numerous flowers (van Ee, 1997)). However, mango is a climacteric fruit that ripens rapidly at ambient temperature (Singh et al., 2013). During ripening, mangoes experience various physicochemical changes which are

susceptible to perishability under environmental conditions such as microorganism infection, climacteric respiration, postharvest handling, and storage (Wei et al., 2021).

Mango came to Nigeria in the 20th Century through itinerant merchant missionaries and colonialists where it has become an integral part of indigenous cropping systems (Aiyelaagbe, 2002; Nyishir, 2004). The guinea and sudan savanna zones of Nigeria are credited with producing greater percentage of the fruit in Nigeria (Olaniyan, 2004), with Benue state topping the list (Avav and Uza, 2002). Unfortunately, the history of mango production in the state is not very clear. Reports however indicate that improved mango varieties were introduced to Yandev Farm Centre by the early Agricultural Officers from Zaria and Ibadan in the 1950s (Nyishir, 2004).

The fruit can be put to a number of uses. For instance, ripe fruits can be made into juice and preserves, while unripe fruits can be processed into pickles and chutney (Samson, 1980). However, in Nigeria, most of the fruit produced is consumed as fresh fruit. According to the Food and Agriculture Organization (FAO) in 2015, Nigeria produced eight hundred and fifty thousand (850,000) tonnes of mango, with Nigeria ranking ninth among these mango-producing countries (Ugese et al.,2012) and Benue state-ranking first (1st) in the league of states that produce mangos in Nigeria (Ubwa et al., 2014).

2.5 HEALTH BENEFITS OF MANGO

Some of the main bioactive compounds identified in mango fruit include phenolic acids (coumaric acid, ferulic acid and hydroxybenzoic acid), polyphenols (quercetin, mangiferin, catechins, tannins, kaempferol, anthocyanins, gallic acid, ellagic acid), carotenoids, which are the most abundant, and the vitamins ascorbic acid, thiamine, riboflavin, and niacin (Wall-Medrano et

al., 2015 Burton-Freeman et al., 2017). These compounds have been reported to exhibit antioxidant activity (Zapata-Londoño et al., 2020), contribute to prevention of cancer (Boatenget al., 2007,Geet al., 2013, Corrales-Bernal et al., 22014a), diabetes mellitus (DM) (Lucas et al., 2011,Gondi et al., 2015,Ediriweera et al.,2015)and cardiovascular disease and inflammatory processes (Xu et al., 2013).

2.6 GENERAL REQUIREMENTS FOR MANGO

Mango is known to have specific requirements for its production and growth. This include temperatures, rainfall, soil type and propagation.

2.6.1 Temperatures

Mango do best on average annual temperature of between 15 to 30 degrees The tree rapidly grows in all tropical and subtropical climates with a mean temperature of 21^0C to 28^0C.The lowest temperatures tolerated by mango are 1^0C to 2^0C (Opeke,1992).The trees also survive in a temperature as high as 45^0C(NDA,2000).

2.6.2 Rainfall

Annual rainfall of 850 to 1000 mm is sufficient for mango cultivation. It should be noted that rainfall during flowering season reduces fruit setting. After the plant is well established it can tolerate drought especially when its tap root reaches the water table.

2.6.3 Soils

Mango plants are adapted to many soil types but prefer deep (at least 3m) soils that are fertile and well drained with optimum pH of 5.5 to 7.5.

2.6.3 Propagation

In mango farming, propagation is primarily done by seeds especially for the indigenous varieties. Exotic varieties are obtained by successfully grafting a scion on the indigenous rootstock. This leads to development of the various dwarf trees. During planting, spacing may vary from 5m by 5m to 8m by 8m depending on the growth habit of the variety.

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 STUDY AREA

This study was carried out at Iguzama Community in Ovia North East Local Government area of Edo state, Nigeria, and covered a total land area of 16 hectares of land. The study area consists of two sites; Site A is a 4 hectare land which lies within Longitude 5°28'25"E ,5°28'30"E and 5°28'35"E and 6°24'45"N and 6°24'40"N Latitude, Site B is a 12 hectare land, lying within Longitude 5°28'30"E and 5°29'0"E and Latitude 6°25'0"N and 6°24'30"N. The annual rainfall is within the range of 1500 mm to 2500 mm with an average of 1900 mm per annum. The average annual temperature ranges from 23 - 37°C. Some of the crops grown include cassava, plantain, Oil palm. The area is situated in the rainforest zone, with two distinct climatic seasons, namely; the rainy and dry seasons. The rainy season is between April and October with a 2-week break in August. The dry season lasts from November to April, with a cloudy, humid and dusty harmattan period between December and January.

The soils here are generally the red Ferrasols, derived from coastal plain sands (unconsolidated sands and Sandy clay) and alluvial deposits (Umweni, 2007). Furthermore, the soil here is formed from Coastal Plain sand, a derivative of sedimentary rock that has under gone intense weathering process arising from high rainfall and temperatures. Topographic position of the study area is a flat terrain with slight height differentia.

The vegetation includes primary forest along the river course; scattered trees of Rubber, Oil palm, Bamboo and Raffia palms; and some old and new farms cultivated to yam, cassava, fluted pumpkin, plantain, banana, pineapple, and so on. The arable land in this area is continuously

cultivated with cassava (*Manihot utilissima*) as the dominant crop. The land is used yearly by farmers.

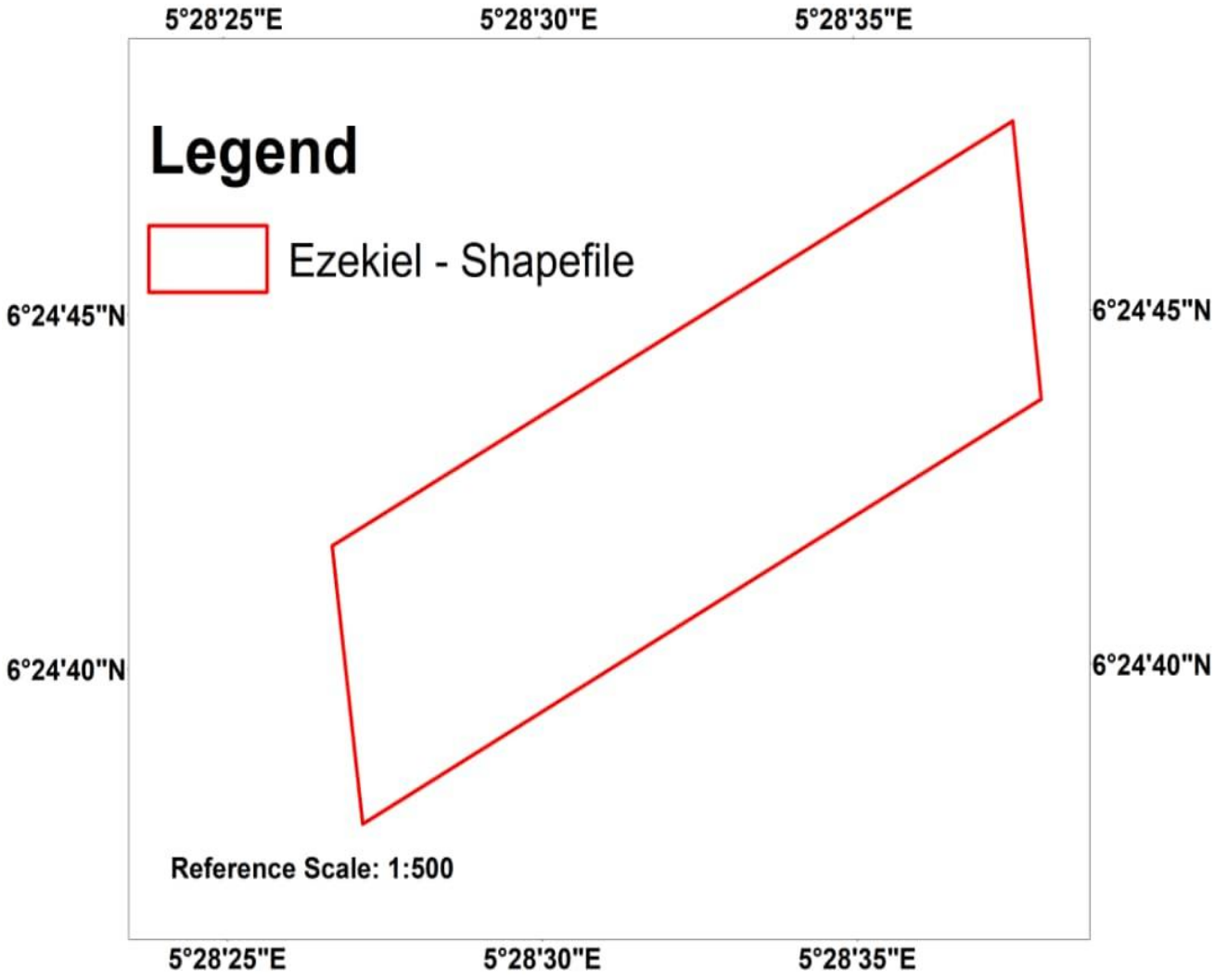

Fig 1.Shapefile of 4 hectares study area

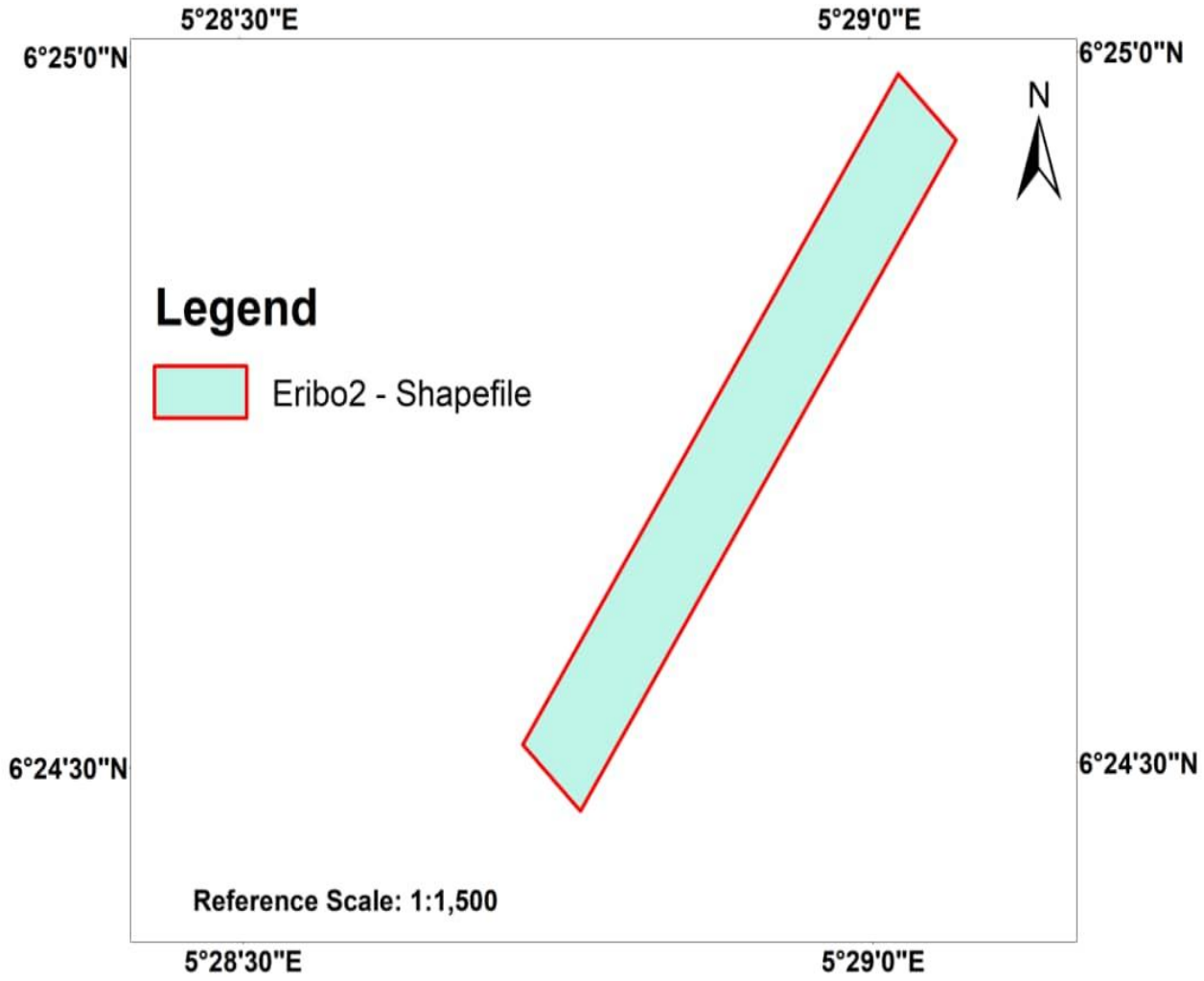

Fig 2.Shapefile of 12 hectares study area

3.2 FIELD STUDIES

A Perimeter survey map of the site was produced which served as a base map. Thereafter, traverses were cut at intervals of 100m from pre determined baseline with the transverses running in both vertical and horizontal directions, making a total of 3 traverses in site A, and 6 traverses in site B. Soil survey by a rigid grid method was conducted at a detailed scale. Auger borings were done at 50 metres apart in site A and 100 meters apart in site B, along the traverses ; auger samples were observed at depth intervals of 0-30cm, 30-60cm, 60-90cm and 90-120cm respectively and were appropriately described morphologically on the field (soil colour, texture by feel, presence or absence of mottles, mottle colour, presence or absence of concretions, etc). Areas with similar properties were put together to form the various mapping units; two (2) mapping units were delineated in each site (sites A and B). Each mapping unit was represented by a pedon that was appropriately described according to FAO,(2006); identified horizons/layers were sampled from bottom to top. The samples were properly bagged labelled and taken to laboratory for analysis.

Fig. 3: Google imagery of 4 Hectares Study area with auger points

Fig. 4: Google imagery of 12 Hectares Study area with auger points

3.3 LABORATORY ANALYSIS

The soil samples from each horizon were air-dried and passed through a 3mm sieve. The sieved samples were analyzed for some physical and chemical properties. Particle size distribution was determined by the hydrometer method (Gee and Or, 2002) after the removal of organic matter content with hydrogen peroxide and dispersion with sodium hexametaphosphate (International Institute for Tropical Agriculture-IITA, 1979). Available P was determined by Bray-I method (Olesen and Sommers, 1982). The Ph was determined with glass electrode pH meter in soil; soil and water at ratio 1:1 (Maclean, 1982). Exchangeable Bases (Na, K, Ca, and Mg) were extracted with neutral normal ammonium acetate (NH4OAC at pH 7.0); Na and K were determined by flame photometer while Ca and Mg were determined by atomic absorption spectrometer (Thomas, 1982). Total N was determined by Macro Kjedhal method (Bremner, 1996). Exchangeable acidity was determined by titration method (Anderson and Ingram, 1993). Organic Carbon was determined by Walkley Black method (Page 1982). Effective Cation Exchange Capacity (ECEC) was obtained by the summation of Exchangeable Bases and Exchangeable Acidity (Tan, 1996). Base saturation was calculated by dividing the sum of Exchangeable Bases (Na, K, Ca and Mg) by the ECEC and multiplying the quotient by 100.

3.4 STATISTICAL ANALYSIS

Data generated by gen stat (version 8.1) statistical was used to determine variability of soil properties within pedons. Coefficient of variation (cv) was ranked according to the procedure ofwilding et al., (1994) where cv < 15 % = low variation, cv ≥ 15 % ≤ 35 % = moderate variation, cv > 35 % = high variation.

3.5 LAND SUITABILITY EVALUATION

The FAO land suitability evaluation is most preferable because its guidelines can be applied in all environment in contrast to other land suitability evaluation systems which were developed for specific environment. It is also based on the soil characteristics and climatic data related to growth requirement of crops being evaluated. Therefore, Potential land suitability is the suitability that can be reached after the land is improved (Brovnsveld, 1994). It is also done in accordance with the principle of the law of the minimum, which states that performance is always determined by the least favorable factor or plant nutrient in the lowest supply (FAO, 1984). Therefore the suitability class of pedon (aggregate suitability) is that indicated by the most limiting (poorest) characteristics of that pedon. This was done using the qualitative method and according to the FAO (1976) frame work for rain-fed agriculture and guidelines provided by (Sys, 1985) for land suitability. Pedons were placed in suitability classes by comparing their land qualities and characteristics with guideline.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 PEDON 1A CHARACTERIZATION

The physical and chemical properties of the soil in pedon 1a are presented in table 4.1. The soil pH ranged from 5.1 to 6.22, which fall between moderately acidic and slightly acidic according to the rating of Chude *et al*., 2011; the value increased irregularly down the profile. The value of electrical conductivity which indicates the amount of salinity ranged from 70.00dsm^{-1} to 109.7dsm^{-1}. Organic carbon in this pedon ranged from 1.30 gkg^{-1} to 23.13 gkg^{-1} while that of organic matter ranges from 2.25 gkg^{-1} to 39.87 gkg^{-1} with the highest value in the surface layer. Total nitrogen (N) values ranged from 0.10 gkg^{-1} to 1.93 gkg$^{-1.}$ The value of Phosphorus ranged from 1.72 mgkg^{-1}to 44.47 mgkg^{-1}. Exchangeable bases: Calcium (Ca) values ranges from 0.43 cmolkg^{-1}to 2.58 cmolkg^{-1} with the top layer having the highest value. Magnesium (Mg) values range from 0.08 cmolkg^{-1} to 0.38 cmolkg^{-1}. Sodium (Na) values ranged from 0.19 cmolkg^{-1} to 0.34 cmolkg^{-1}. Potassium (K) values range from 0.9 cmolkg^{-1} to 0.19 cmolkg^{-1} with highest values at the top layer and decreasing irregularly down the profile. Exchangeable acidity: Hydrogen (H) value ranged from 0.1cmolkg^{-1} to 0.26cmolkg^{-1} with an irregular increase and decrease down the profile. The Aluminum values ranged from 0.006 cmolkg^{-1} to 0.922 cmolkg^{-1}. The Cation Exchange Capacity (CEC) values ranged from 36.00 cmolkg^{-1} to 94.00 cmolkg^{-1}. The Effective Cation Exchange Capacity (ECEC) values ranged from 2.03 cmolkg^{-1} to 3.58 cmolkg^{-1}, both increasing and decreasing irregularly down the profile. The percentage Base saturation (BS) of the soil ranged from 37.93% to 97.21%. In particle size distribution, Clay values ranged from 30.00% to 140.00%. Silt values ranged from 10.00% to 40.00% and Sand values ranged from

830.00% to 960.00%. The textural class is Sand(S). Mean value ranges from 0.18 $cmolkg^{-1}$ (Mg) to 886.00 gkg^{-1} (sand). SE values ranged from 0.07 $cmolkg^{-1}$ (Na) to 53.20 gkg^{-1} (Sand), CV values ranged from 6.00 gkg^{-1} (Sand) to 156.20 $mgkg^{-1}$ (Avail. P).

Table 4.1: The physical and chemical properties of the soil in pedon 1a

Pedon ID	Horizon Design.	Horizon Depth	pH	EC	Org. C	Org. matter	Total N.	Avail P	Ca	Mg	Na	K	H	Al	ECEC	CEC	ECECCLAY	BS	SAND	SILT	CLAY	TC
		(cm)	H20	µS/cm	gkg^{-1}		gkg^{-1}	$mgkg^{1}$	←							→	←	gkg^{-1} →				
												$cmolkg^{-1}$										
	Ap	0-13	6.22	109.70	23.13	39.87	1.93	44.47	2.58	0.38	0.34	0.19	0.1	0.00	3.58	94.00	119.33	97.21	960.00	10.00	30.00	S
	AB	13-33	5.1	70.00	7.98	13.76	0.66	7.18	0.60	0.15	0.19	0.08	0.24	1.06	2.33	36.00	38.83	44.09	920.00	20.00	60.00	S
	BA	33-69	4.86	95.70	4.23	7.30	0.35	3.05	0.43	0.23	0.19	0.05	0.26	1.20	2.35	60.20	26.11	37.93	870.00	40.00	90.00	S
	B1	69-121	5.02	46.30	3.09	5.33	0.24	2.46	0.55	0.08	0.24	0.07	0.18	0.92	2.03	70.66	16.91	45.87	850.00	30.00	120.00	LS
	B2	121-180	5.02	65.10	1.30	2.25	0.10	1.72	0.55	0.08	0.29	0.17	0.16	0.82	2.06	74.50	14.71	52.52	830.00	30.00	140.00	LS
Mean			5.24	77.36	7.90	13.70	0.66	11.80	0.94	0.18	0.25	0.11	0.19	0.80	2.47	67.10	43.00	56.00	886.00	26.00	88.00	
SE			0.55	25.30	8.83	15.22	0.74	18.40	0.92	0.13	0.07	0.06	0.06	0.47	0.64	31.70	43.60	23.90	53.20	11.40	44.40	
CV			10.5	32.60	111.2	111.10	113.00	156.20	97.40	68.40	26.10	56.60	34.10	58.70	25.80	21.30	101.00	43.00	6.00	43.90	50.40	
Ranking			LV	MV	HV	HV	HV	HV	HV	HV	MV	HV		HV	MV	MV	HV	HV	LV	HV	HV	

4.1.1 Suitability Classification of Pedon 1a For Mango Cultivation

Based on the guidelines provided by Sys (1985), the following parameters were used in the evaluation of pedon 1a for mango cultivation.

CLIMATE: Among the climate parameter the most important to crop production is the amount and distribution of rainfall. This annual rainfall is within the range of 1500mm to 2500mm with an average of 1900mm per annum (NIFOR, 2013). This according to guideline falls in the class S1 (highly suitable). The mean annual temperature of the study site ranges from 23^0C to 37^0C with the mean of 30^0C; this also places the pedon in class S1 (highly suitable). The length of dry season ranges from 2-3 months this places the pedon class S1 (highly suitable). Therefore pedon 1a is highly suitable for mango in terms of climate.

TOPOGRAPHY: The topography of this pedon falls into class of S1 (highly suitable) for mango cultivation based on the guidelines.

WETNESS: Pedon 1a is well drainage; with no flooding problem. This qualifies the pedon as S1 (highly suitable).

SOIL PHYSICAL CHARACTERISTICS: The soil depth in the study area of pedon 1a was 180cm which according to the guideline places this pedon in suitability class, S1 (highly suitable). The texture is Sand which places the pedon in suitability S3 (marginally suitable).

FERTILITY CHARACTERISTICS: This considers the current fertility of the soil; which refers to chemical fertility that put into consideration, the properties that are not easily altered (Cation Exchange Capacity, Base Saturation and pH) as well as the requirement for potential fertility as it affects the production of mango. The pH value ranged from 4.86 to 6.22 with an average of 4.2 which according to the guideline is marginally suitable (S3). The CEC value was

67.07 cmolkg^{-1}which makes the pedon highly suitable (S1). The Base saturation is >35, placing the pedon in class S1 (highly suitable). Organic matter is >1.2 and placed the pedon under suitability class of S1 (highly suitable).

AGGREGATE SUITABILITY CLASS: The ratings of the land characteristics and aggregate rating of pedon is for both the potential and the current suitability by considering all the characteristics using the law of minimum by FAO (1984), which states that performance is always determined by the least favourable factor or plant nutrient in the lowest supply.

CURRENT SUITABILITY: On aggregate suitability rating, pedon 1a which occupies 1.65 hectares and covers a land area of 41.2% was marginally suitable (S3) for mango cultivation with limitations in soil physical characteristics (texture).

POTENTIAL SUITABILITY: Aggregate suitability rating on potential basis, showed that pedon 1a which represents 1.65% hectares and covers a land area of 41.2% was marginally suitable (S3) for mango cultivation due to limitations in soil physical characteristics (texture).

Table 4.2: Mango Suitability Evaluation for Pedon 1a

Land Characteristics	Suitability Class
CLIMATE (c)	
Rainfall (mm)	1900(S1)
Dry season (months)	2-3 months (S1)
Temperature (^{0}C)	30^{0}C (S1)
TOPOGRAPHY(t)	
Slope %	2.59-6.09(S1)
WETNESS (w)	
Drainage	Well drained (S1)
Flooding	F0 (S1)
SOIL PHYSICAL CHARACTERISTICS (S)	
Soil depth (cm)	>100 (S1)
Texture/Structure (Surface)	S (S3)
FERTILITY (f)	
CEC (ECEC) Clay (cmolkg^{-1})	67.07 (S1)
Base Saturation (%)	55.00 (S1)
Organic matter	1.37 (S1)
pH	4.2 (S3)
AGGREGATE SUITABILITY CLASS	
Current	S3(s)
Potential	S3(s)
Size (Hectare)	1.65
% coverage	41.25%

Table 4.3: Land Requirements for Mango Cultivation

Land Characteristics	Suitability class			
	S1	S2	S3	NS
CLIMATE ©				
Rainfall (mm)	1700-2000+	1450-1700	1000-1450	<700
Dry season (months)	2-3	3-4	4-6	>6
Temperature (^{0}C)	25-32	20-25	18-	<18
WETNESS (w)				
Drainage	Well	-	-	Moderate
Flooding	F0	-	-	F1
TOPOGRAPHY (t)				
Slope%	0-8	8-16	16-30	>30
SOIL PHYSICAL CHARACTERISTICS (S)				
Soil depth (cm)	>100	70-100	50-70	<50
Texture/Structure (Surface)	LS, SL, SCL, CL	SC	S,LC	C
FERTILITY (f)				
CEC (ECEC) Clay (cmolkg^{-1})	>16	10-16	5-10	<5
Base Saturation (%)	>35	20-35	-	<20
Organic matter	>1.2	0.8-1.2	0.4-0.8	<0.4
pH	6.7	5.6	4-5	<4

Source: Aruleba and Ayodele (2015)

4.2 PEDON 2A CHARACTERISTICS

The physical and chemical properties of the soil in pedon 2a are presented in Table 4.4. The soil pH ranged from 5.5 to 6.14, with values decreasing irregularly down the profile. The Electrical conductivity which indicates the amount of salinity ranged from 25.5 dsm^{-1} to 97.8 dsm^{-1} the value decreased down the profile. Total Organic Matter in this pedon ranges from 4.21 gkg^{-1} to 24.15 gkg^{-1} with the highest value in the surface layer while that of Total Organic carbon ranged from 2.44 gkg^{-1} to 14.01 gkg^{-1} with the highest value in the surface layer. Total nitrogen (N) values ranged from 0.3 gkg^{-1} to 1.17 gkg^{-1}. The value of Phosphorus ranged from 1.3 $mgkg^{-1}$ to 13.14 $mgkg^{-1}$. Exchangeable bases: Calcium (Ca) values ranged from 0.40 $cmolkg^{-1}$to 1.70 $cmolkg^{-1}$ with the top layer having the highest value. Magnesium (Mg) values ranged from 0.10 $cmolkg^{-1}$ to 0.25 $cmolkg^{-1}$. Sodium (Na) values ranged from 0.14 $cmolkg^{-1}$ to 0.43 $cmolkg^{-1}$. Potassium (K) values ranged from 0.01 $cmolkg^{-1}$ to 0.29$cmolkg^{-1}$ with highest values at the top layer and decreased regularly down the profile. Exchangeable Acidity: Hydrogen (H) value ranged from 0.1 $cmolkg^{-1}$ to 0.18 $cmolkg^{-1}$. The Aluminum values ranges from 0.00 $cmolkg^{-1}$ to 0.86 $cmolkg^{-1}$. The Cation Exchange Capacity (CEC) values range from 64.00 $cmolkg^{-1}$ to 163.42$cmolkg^{-1}$. The percentage Base saturation (BS) of the soil range from 75.66% to 89.32%. For particle size distribution, Clay values ranged from 32.00% to 310.00%. Silt values ranged from 10.00% to 44.00% and Sand values ranged from 680.00% to 924.00%. The textural is Sand(S). Mean value ranged from 0.09 $cmolkg^{-1}$ (K) to 787.00 gkg^{-1} (Sand), SE values ranged from 0.04 $cmolkg^{-1}$ (H) to 103.30 gkg^{-1} (Clay), CV values ranged from 0.42 $cmolkg^{-1}$ (Al) to 833.1 gkg^{-1} (Organic Carbon).

Table 4.4: Physical and Chemical Properties of Pedon 2a

Pedon ID	Horizon Design.	Horizon Depth (cm)	pH H20	EC µS/cm	Org. C gkg^{-1}	Org. matter	Total N. gkg^{-1}	Avail P mgkg^{1}	Ca	Mg	Na	K	H	Al	ECEC	CEC	ECECCLAY	BS gkg^{-1}	SAND	SILT	CLAY	TC
									←			cmolkg^{-1}				→	←		→			
	Ap	0-15	6.14	97.80	14.01	24.15	1.17	13.14	1.70	0.25	0.43	0.29	0.1	0.00	2.78	64.00	86.88	75.68	924.00	44.00	32.00	S
	Bt1	15-39	5.5	46.20	5.86	10.11	0.49	2.63	0.60	0.10	0.24	0.11	0.18	0.86	2.09	100.00	13.06	89.32	800.00	40.00	160.00	SL
	Bt2	39-76	5.34	34.80	3.58	6.18	0.30	1.30	0.50	0.10	0.14	0.02	0.18	1.00	1.94	107.36	10.21	84.22	790.00	20.00	190.00	SL
	Bt3	76-127	5.26	32.50	2.93	5.05	0.24	1.80	0.40	0.15	0.19	0.01	0.2	1.00	1.95	130.10	8.13	75.66	740.00	20.00	240.00	SCL
	Bt4	127-169	5.66	25.50	2.44	4.21	0.19	2.38	0.97	0.18	0.19	0.01	0.16	0.70	2.21	163.42	7.13	61.09	680.00	10.00	310.00	SCL
Mean			5.58	47.00	5.80	9.90	0.48	4.20	0.83	0.16	0.24	0.09	0.16	0.71	2.19	113.00	25.00	77.20	787.00	26.80	186	
SE			0.35	29.20	4.79	8.26	0.40	5.00	0.53	0.06	0.11	0.12	0.04	58.50	0.35	36.90	34.60	10.73	90.30	14.53	103.30	
CV			6.20	61.60	833.1	83.10	84.40	117.60	63.50	40.20	47.5	136.90	23.50	0.42	15.80	32.60	138.00	13.90	11.50	54.20	55.40	
Ranking			LV	HV	HV	HV	HV	HV	HV	HV	HV	HV	MV	LV	MV	MV	HV	LV	LV	HV	HV	

4.2.1 SUITABILITY CLASSIFICATION OF PEDON 2A FOR MANGO CULTIVATION

Based on the guidelines provided by Sys (1985), the following parameters were used in the evaluation of pedon 2a for mango cultivation.

CLIMATE: Among the climate parameter the most important to crop production is the amount and distribution of rainfall. This annual rainfall is within the range of 1500mm to 2500mm with an average of 1900mm per annum (NIFOR, 2013). This according to guideline falls in the class S1 (highly suitable). The mean annual temperature of the study site ranges from 23^0C to 37^0C with the mean of 30^0C; this also places the pedon in class S1 (highly suitable). The length of dry season ranges from 2-3 months this places the pedon class S1 (highly suitable). Therefore pedon 2 is highly suitable for mango in terms of climate.

TOPOGRAPHY: The topography of this pedon (slope) ranges from 0.79-2.6% and falls into class of S1 (highly suitable) for mango cultivation based on the guidelines.

WETNESS: The study area of pedon 2a was well drained, with no flooding problem. This qualifies the pedon as S1 (highly suitable).

SOIL PHYSICAL CHARACTERISTICS: The texture is Sand (S) this put the pedon in suitability class S3 (marginally suitable). The soil depth in the study area of pedon 2a was 169cm which according to the guidelines places this pedon in suitability class of S1 (highly suitable)

FERTILITY CHARACTERISTICS: This considers the current fertility of the soil; which refers to chemical fertility that takes into consideration, the properties that are not easily altered (Cation Exchange Capacity, Base Saturation and pH) as well as the requirement for potential fertility as it affects the production of mango. The pH value ranged from 5.5 to 6.14 with an average of 5.5 which according to guideline is moderately suitable (S2). The CEC value ranged

from 64.00 cmolkg^{-1} to 163.42 cmolkg^{-1}which falls according to guideline under S1 (highly suitable) for mango cultivation. The Base saturation is >35 placing the pedon in class S1 (highly suitable). Organic matter is >1.2 and placed the pedon under suitability class of S1 (highly suitable) for mango cultivation.

AGGREGATE SUITABILITY CLASS: The ratings of the land characteristics and aggregate rating of pedon 2a is for both the potential and the current suitability by considering all the characteristics using the law of minimum by FAO (1984), which states that performance is always determined by the least favourable factor or plant nutrient in the lowest supply.

CURRENT SUITABILITY: On aggregate suitability rating, pedon 2a which represents 2.64 hectares and covers a land area of 66% was marginally suitable (S3) for mango cultivation with limitations in soil physical characteristics (texture).

POTENTIAL SUITABILITY: Aggregate suitabilityrating on potential basis, showed that pedon 2a which represents 2.64 hectares and covers a land area of 66% was marginally suitable for mango cultivation with limitation in soil physical characteristics (texture)

Table 4.5: Mango Suitability Evaluation for Pedon2a

Land Characteristics	Suitability class
CLIMATE (c)	
Rainfall (mm)	1900(S1)
Dry season (months)	2-3 months (S1)
Temperature (^{0}C)	30^{0}C (S1)
WETNESS (w)	
Drainage	Well drained(S1)
Flooding	F0 (S1)
TOPOGRAPHY (t)	
Slope%	0.79%-2.6% (S1)
SOIL PHYSICAL CHARACTERISTICS (S)	
Soil depth (cm)	169 (S1)
Texture/Structure (Surface)	S (S3)
FERTILITY (f)	
CEC (ECEC) Clay (cmolkg^{-1})	112.97 (S1)
Base Saturation (%)	77.19 (S1)
Organic	10.82(S1)
pH	5.5(S2)
AGGREGATE CLASS	
Current	S3(s)
Potential	S3(s)
Area covered (Hectare)	2.64
% coverage	66%

4.3 PEDON 1B CHARACTERIZATION

The physical and chemical properties of the soil in pedon1b are presented in table 4.6. The soil pH ranged from 5.18 to 6.38 with values decreasing irregularly down the profile. The Electrical Conductivity which indicates the amount of salinity ranges from 33.80 dsm^{-1} to 61.90 dsm^{-1} the value decreased down the profile. Organic carbon in this pedon ranged from 1.71 $gkg^{-1}$to 9.12 gkg^{-1} with the highest value in the surface layer while Organic Matter ranges from 2.95gkg^{-1} to 15.72 gkg^{-1} with values decreasing regularly down the profile. Total nitrogen (N) values ranged from 0.15 gkg^{-1} to 0.76 gkg^{-1} decreasing generally down the profile. The value of phosphorus ranged from 2.46 $mgkg^{-1}$ to 5.61 $mgkg^{-1}$. Exchangeable bases: Calcium (Ca) values ranged from 0.42 $cmolkg^{-1}$ to 1.60 $cmolkg^{-1}$ with the top layer having the highest value. Magnesium (Mg) values ranged from 0.19$cmolkg^{-1}$ to 0.30$cmolkg^{-1}$. Sodium (Na) values ranged from 0.1$cmolkg^{-1}$ to 0.24 $cmolkg^{-1}$. Potassium (K) values ranged 0.01$cmolkg^{-1}$to 0.08 $cmolkg^{-1}$ with highest values at the top layer and decreasing regularly down the profile. Exchangeable Acidity: Hydrogen (H) value ranges from 0.04 $cmolkg^{-1}$ to 0.23 $cmolkg^{-1}$. The Cation Exchange Capacity (CEC) values ranged from 71.44 $cmolkg^{-1}$ to 103.16 $cmolkg^{-1}$. The percentage Base saturation (BS) of the soil ranged from 39.79% to 94.64% decreasing in an irregular pattern down the profile. For particle size dist ribution,Clay values ranged from 80.00% to 190.00%. Silt values ranged from 10.00% to 20.00% and Sand values ranged from 800.00% to 900.00%. The textural class is Sand (S). Mean value ranged from 0.03 $cmolkg^{-1}$ (K) to 842.00 gkg^{-1} (Sand), SE values ranged from 0.03 $cmolkg^{-1}$ (K) to 46.00 gkg^{-1} (Clay), CV values ranged from 5.10% (BS) to 86.70 $cmolkg^{-1}$ (K).

TABLE 4.6: Physical and Chemical Properties of Pedon1b

Pedon ID	Horizon Design.	Horizon Depth	**pH**	EC	**Org. C**	**Org. matter**	**Total N.**	**Avail P**	**Ca**	**Mg**	**Na**	**K**	**H**	**Al**	**ECEC**	**CEC**	**ECECCLAY**	**BS**	**SAND**	**SILT**	**CLAY**	**TC**
		(cm)	**H20**	µS/cm	**gkg^{-1}**		**gkg^{-1}**	**mgkg1**	← **$cmolkg^{-1}$** →								← **gkg^{-1}** →					
	Ap	0-11	6.38	61.90	9.12	15.72	0.76	5.61	1.60	0.20	0.24	0.08	0.04	0.08	2.24	71.44	28.00	94.64	900.00	20.00	80.00	S
	Bw1	11-27	5.58	47.70	5.86	10.11	0.49	2.55	0.75	0.30	0.14	0.03	0.16	0.52	1.90	80.00	15.83	64.25	860.00	20.00	120.00	LS
	Bw2	27-59	5.26	41.20	4.15	7.16	0.35	3.05	0.46	0.19	0.19	0.02	0.19	1.10	2.16	84.32	15.43	40.14	850.00	10.00	140.00	LS
	Bw3	59-101	5.18	39.10	3.09	5.33	0.26	2.63	0.42	0.28	0.1	0.02	0.23	1.00	2.04	103.16	11.03	39.79	800.00	15.00	185.00	SL
	Bw4	101-175	5.26	33.80	1.71	2.95	0.15	2.46	0.50	0.25	0.19	0.01	0.16	1.12	2.23	100.90	11.74	42.71	800.00	10.00	190.00	SL
Mean			5.53	44.70	4.80	8.30	0.40	3.26	0.75	0.24	0.17	0.03	0.16	0.76	2.11	88.00	16.40	56.00	842.00	15.00	143.00	
SE			5.00	10.81	2.86	4.93	0.24	1.33	0.49	0.05	0.05	0.03	0.07	0.46	0.14	15.50	6.83	23.70	42.70	5.00	46.00	
CV			9.00	24.20	59.70	59.70	58.60	40.90	66.30	19.80	31.10	86.70	45.50	59.40	6.80	13.67	41.60	42.10	5.10	33.30	32.20	
Ranking			LV	MV	HV	HV	HV	HV	HV	MV	MV	HV	HV	HV	LV	LV	HV	HV	LV	MV	MV	

4.3.1 SUITABILITY CLASSIFICATION OF PEDON 1B FOR MANGO CULTIVATION

Based on the guidelines provided by Sys (1985), the following parameters were used in the evaluation of pedon1b for mango cultivation.

CLIMATE: Among the climate parameter the most important to crop production is the amount and distribution of rainfall. This annual rainfall is within the range of 1500mm to 2500mm with an average of 1900mm per annum (NIFOR, 2013). This according to guideline falls in the class S1 (highly suitable). The mean annual temperature of the study site ranges from 23^0C to 37^0C with the mean of 30^0C; this also places the pedon in class S1 (highly suitable). The length of dry season ranges from 2-3 months this places the pedon class S1 (highly suitable). Therefore pedon1b is highly suitable for mango in terms of climate.

TOPOGRAPHY: The topography of this pedon ranges from 0.2% to 2.1% which falls into class of S1 (highly suitable) for mango cultivation based on the guidelines.

WETNESS: The study area of pedon1b was well drained with no flooding problem. This qualifies the pedon as S1 (highly suitable).

SOIL PHYSICAL CHARACTERISTICS: The soil depth in the study area of pedon1b was 175cm which according to the guideline places this pedon to be in suitability class of S1 (highly suitable). The texture was sand (S) and it places the pedon in suitability class of S3 (marginally suitable).

FERTILITY CHARACTERISTICS: This considers the current fertility of the soil; which refers to chemical fertility that takes into consideration, the properties that are not easily altered

(Cation Exchange Capacity, Base Saturation and pH) as well as the requirement for potential fertility as it affects the production of mango. The pH value ranged from 5.18 to 6.38 with an average of 4.4, which according to guideline falls under class S3 (moderately suitable). The CEC value ranged from 71.44 $cmolkg^{-1}$to 103.16 $cmolkg^{-1}$ which falls according to guideline under S1 (highly suitable) for mango cultivation. The base saturation is >35 placing the pedon in class S1 (highly suitable). Organic matter values ranges from 0.8 to 1.2 and placed the pedon in suitability class S2 (moderate suitable) for mango cultivation.

AGGREGATE SUITABILITY CLASS: The ratings of the land characteristics and aggregate rating of pedon is for bother the potential and the current suitability by considering all the characteristics using the law of minimum by FAO (1984), which states that performance is always determined by the least favourable factor or plant nutrient in the lowest supply.

CURRENT SUITABILITY: On aggregate suitability rating, pedon1b which occupies 6.4 hectares and covers a land area of 53.3% was marginally suitable for mango cultivation with severe limitations in soil physical characteristics (texture) and fertility (pH)

POTENTIAL SUITABILITY: Aggregate suitability rating on potential basis, showed that pedon1b which represents 6.4 hectares and covers a land area of 53.3% was marginally suitable (S3) for mango cultivation due to severe limitation soil physical characteristics (texture).

Table 4.7: Mango Suitability Evaluation for Pedon1b

Land Characteristics	Suitability class
CLIMATE (c)	
Rainfall (mm)	1900(S1)
Dry season (months)	2-3 months (S1)
Temperature (^{0}C)	30^{0}C (S1)
WETNESS (w)	
Drainage	Well drained (S1)
Flooding	F0 (S1)
TOPOGRAPHY (t)	
Slope (%)	0.2-2.1 % (S1)
SOIL PHYSICAL CHARACTERISTICS (S)	
Soil depth (cm)	>100 (S1)
Texture/Structure (Surface)	S(S3)
FERTILITY (f)	
CEC (ECEC) Clay (cmolkg^{-1})	87.96(S1)
Base Saturation (%)	56.30(S1)
Organic matter	0.99(S2)
pH	4.4 (S3)
AGGREGATE CLASS	
Current	S3(s,f)
Potential	S3(s)
Size (Hectare)	6.4
% coverage	53.3

4.4 PEDON 2B CHARACTERIZATION

The physical and chemical properties of the soil in pedon2b are presented in table 4.8. The soil pH ranged from 5.26 to 5.82 with values decreasing irregularly down the profile. The Electrical Conductivity which indicates the amount of salinity ranges from 29.10 dsm^{-1} to 63.20dsm^{-1} with values decreasing down the profile. Organic carbon in this pedon ranged from 2.04gkg^{-1} to 19.22gkg^{-1} with the highest value in the surface layer while Organic Matter values ranges from 3.51 gkg^{-1} to 33.13 gkg^{-1} with values decreasing regularly down the profile. Total nitrogen (N) values ranged from 0.17 gkg^{-1} to 1.64 gkg^{-1} decreasing generally down the profile. The value of phosphorus ranged from 1.72 $mgkg^{-1}$ to 6.48 $mgkg^{-1}$. Exchangeable bases: Calcium (Ca) values ranged from 0.36 $cmolkg^{-1}$ to 1.50 $cmolkg^{-1}$ with the top layer having the highest value. Magnesium (Mg) values ranged from 0.19 $cmolkg^{-1}$ to 0.50 $cmolkg^{-1}$. Sodium (Na) values ranged from 0.10 $cmolkg^{-1}$ to 0.24 $cmolkg^{-1}$. Potassium (K) values ranged from 0.01 $cmolkg^{-1}$ to 0.12 $cmolkg^{-1}$ with highest values at the surface layer and decreasing regularly down the profile. Exchangeable Acidity: Hydrogen (H) value ranged from 0.08 $cmolkg^{-1}$ to 0.22 $cmolkg^{-1}$. The Aluminum values ranges from 0.10 $cmolkg^{-1}$ to 1.25 $cmolkg^{-1}$. The Cation Exchange Capacity (CEC) values ranged from 84.66 $cmolkg^{-1}$ to 167.02 $cmolkg^{-1}$. The percentage Base saturation (BS) of the soil ranged from 38.16% to 92.92%. For particle size distribution, Clay values ranged from 70.00% to 320.00%, Silt values ranged from 10.00% to 30.00% and Sand values ranged from 660.00% to 900.00%. The textural class is Sand (S). Mean value ranged from 0.03 $cmolkg^{-1}$ (K) to 792.00 gkg^{-1} (Sand), SE values ranged from 0.05 $cmolkg^{-1}$ (H) to 79.50 gkg^{-1} (ECEC Clay), CV values ranged from 4.4 (pH) to 142.00 $cmolkg^{-1}$ (K).

TABLE 4.8: Physical and Chemical Properties of pedon 2b

Pedon ID	Horizon Desi gn.	Horizon Depth (cm)	pH H20	EC µS/cm	Org. C gkg^{-1}	Org. matter	Total N. gkg^{-1}	Avail P mgkg^{1}	Ca	Mg	Na	K	H	Al	ECEC	CEC	ECECCLAY	BS gkg^{-1}	SAND	SILT	CLAY	TC
									←							→	←		→			
												cmolkg^{-1}										
	Ap	0-17	5.82	63.20	19.22	33.13	1.64	6.48	1.50	0.50	0.24	0.12	0.08	0.10	2.54	101.26	36.28	92.92	900.00	30.00	70.00	S
	Bt1	17-34	5.26	36.50	5.70	9.83	0.47	2.71	0.46	0.19	0.10	0.02	0.22	0.98	1.96	84.66	15.08	38.87	850.00	20.00	130.00	SL
	Bt2	34-78	5.34	34.30	4.23	7.30	0.35	5.00	0.43	0.27	0.10	0.01	0.19	1.11	2.10	114.60	10.50	38.16	790.00	10.00	200.00	SCL
	Bt3	78-116	5.26	32.00	3.09	5.33	0.26	2.71	0.42	0.18	0.10	0.01	0.17	1.25	2.12	125.60	9.22	33.08	760.00	10.00	230.00	SCL
	Bt4	116-183	5.34	29.10	2.04	3.51	0.17	1.72	0.36	0.19	0.14	0.01	0.19	0.90	1.79	167.02	5.59	39.12	660.00	20.00	320.00	SCL
Mean			5.40	39.00	6.90	11.80	0.58	3.72	0.63	0.27	0.14	0.03	0.17	0.87	2.10	119.00	15.30	48.00	792.00	18.00	190.00	
SE			0.24	13.79	7.04	12.14	0.61	1.96	0.49	0.14	0.06	0.05	0.05	0.45	0.28	26.20	79.50	51.60	11.60	46.50	50.30	
CV			4.4	35.3	102.70	102.70	104.50	52.50	76.60	51.00	44.60	142.00	31.40	51.80	13.20	31.10	12.19	25.00	91.50	8.37	95.70	
Ranking			LV	HV	HV	HV	HV	HV	HV	HV	HV	HV	HV	HV	HV	HV	LV	MV	HV	LV	HV	

4.4.1 SUITABILITY CLASSIFICATION OF PEDON 2B FOR MANGO CULTIVATION

Based on the guidelines provided by Sys (1985), the following parameters were used in the evaluation of pedon2b for mango cultivation.

CLIMATE: Among the climate parameter the most important to crop production is the amount and distribution of rainfall. This annual rainfall is within the range of 1500mm to 2500mm with an average of 1900mm per annum (NIFOR, 2013). This according to guideline falls in the class S1 (highly suitable). The mean annual temperature of the study site ranges from 23^0C to 37^0C with the mean of 30^0C; this also places the pedon in class S1 (highly suitable). The length of dry season ranges from 2-3 months this places the pedon class S1 (highly suitable). Therefore pedon 4 is highly suitable for mango in terms of climate.

TOPOGRAPHY: The topography of this pedon ranges from 2% to 5.9% which falls into class of S1 (highly suitable) for mango cultivation based on the guidelines.

WETNESS: The study area of pedon 2b was well drained with no flooding problem. This qualifies the pedon as S1 (highly suitable).

SOIL PHYSICAL CHARACTERISTICS: The soil depth in the study area of pedon 2b was 183cm which according to the guideline places this pedon to be in suitability class S1 (highly suitable). The texture is Sand (S) and it places the pedon in suitability of S3 (marginally suitable).

FERTILITY CHARACTERISTICS: This considers the current fertility of the soil, which refers to chemical fertility that takes into consideration, the properties that are not easily altered (Cation Exchange Capacity, Base Saturation and pH) as well as the requirement for potential

fertility as it affects the production of plantain. The pH value ranged from 5.26 to 5.82 with an average of 4.3 which according to guideline falls under class S3 (marginally suitable). The CEC value was 118.62 $cmolkg^{-1}$ which falls according to guideline under S1 (highly suitable) for mango cultivation. The base saturation is >35 placing the pedon in class S1 (highly suitable). Organic matter is >1.2 which places the pedon under suitability class of S1 (highly suitable) for mango cultivation.

SUITABILITY CLASS: The ratings of the land characteristics and aggregate rating of pedon is for both the potential and the current suitability by considering all the characteristics using the law of minimum by FAO (1984), which states that performance is always determined by the least favourable factor or plant nutrient in the lowest supply.

CURRENT SUITABILITY: On aggregate suitability rating, pedon2b which occupies 5.69 hectares and covers a land area of 47.41% was marginally suitable for mango cultivation with limitation soil physical characteristics (texture).

POTENTIAL SUITABILITY: Aggregate suitability rating on potential basis, showed that pedon 2b which represents 5.69 hectares and covers a land area of 47.41% was moderately suitable for mango cultivation due to limitation in soil physical characteristics (texture).

Table 4.9: Mango Suitability Evaluation for Pedon2b

Land Characteristics	Suitability class
CLIMATE (c)	
Rainfall (mm)	1900(S1)
Dry season (months)	2-3 months (S1)
Temperature (^{0}C)	30^{0}C (S1)
WETNESS (w)	
Drainage	Well drained (S1)
Flooding	F0 (S1)
TOPOGRAPHY (t)	
Slope (%)	2-5.9% (S1)
SOIL PHYSICAL CHARACTERISTICS (S)	
Soil depth (cm)	>100 (S1)
Texture/Structure (Surface)	S (S3)
FERTILITY (f)	
CEC (ECEC) Clay (cmolkg^{-1})	118.62(S1)
Base Saturation (%)	48.43(S1)
Organic matter	1.18 (S1)
pH	4.3 (S3)
AGGREGATE CLASS	
Current	S3(s,f)
Potential	S3(s)
Size (Hectare)	5.69
% coverage	47.41

Table 4.10: Summary Table for Mango Suitability Classification for Pedons

Land Characteristics	Suitability class			
	Pedon 1a	Pedon 2a	Pedon1b	Pedon2b
CLIMATE (c)				
Rainfall (mm)	1900(S1)	1900(S1)	1900(S1)	1900(S1)
Dry season (months)	2-3 (S1)	2-3 (S1)	2-3 (S1)	2-3 (S1)
Temperature (^{0}C)	30^{0}C	30^{0}C	30^{0}C	30^{0}C
TOPOGRAPHY (t)				
Slope (%)	2.59-6.09(S1)	0.79-2.6(S1)	0.2-2.1(S1)	2-5.9(S1)
WETNESS (w)				
Drainage	Well (S1)	Well (S1)	Well (S1)	Well (S1)
Flooding	F0(S1)	F0(S1)	F0 (S1)	F0(S1)
SOIL PHYSICAL CHARACTERISTICS (S)				
Soil depth (cm)	>100(S1)	>100(S1)	>100(S1)	>100(S1)
Texture	S (S3)	S(S3)	S(S3)	S(S3)
SOIL FERTILITY (f)				
Base Saturation (%)	55.50 (S1)	77.19(S1)	56.30(S1)	48.43 (S1)
Organic matter	1.37 (S1)	0.82 (S2)	0.99(S2)	1.18(S1)
CEC, cmolkg^{-1}	67,07(S1)	112.97(S1)	87.96(S1)	118.62(S1)
Soil pH	4.2(S3)	5.5 (S2)	4.4 (S3)	4.3(S3)
AGG.STABILITY CLASS				
Current Suitability	S3(s)	S3(s)	S3(s,f)	S3(s,f)
Potential Suitability	S3(s)	S3(s)	S3(s)	S3(s)
Size (Hectare)	1.65	2.64	6.4	5.69
% coverage	41.25	66	53.3	47.41

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATION

Land suitability evaluation was carried out to determine the suitability of a 16 (4 and 12) hectares of land in Iguzama community of Edo state for the cultivation of mango.

Rigid grid survey method was carried out at a detailed scale on a 4 and 12 hectares of land. Traverses were cut at intervals of 100m from pre-determined baseline with the transverses running in both vertical and horizontal directions, site A 3 making a total for 16 traverses. Auger boring were done at 100meters apart along the traverses. Four mapping units were delineated; each mapping units was represented by a pedon which was appropriately described.

The study area of Pedon 1a having sand ranging from 830.00-960.00, silt 10.00-40.00, clay 30.00-140.00. Soil physical characteristics (pH) ranges from 5.5-6.14. Pedon 2a having sand ranging from 680.00-924.00, silt 10.00-44.00, clay 32.00-310.00.Soil physical characteristics (pH) 5.5-6.14. Pedon 1a with ranging from 800.00-900.00, silt 10.00-20.00, clay 80.00-190.00. Soil physical characteristics (pH) ranges from 5.18-6.38. Pedon 2b having sand ranging from 660-900.00, silt 10.00-30.00, clay 70.00-320.00. Soil physical characteristics (pH) ranges from 5.26-5.82.

The result of land Suitability evaluation showed that pedon 1a, representing 1.65 hectares and covering a land area of 41.25%, Pedon 2a representing 2.64 hectares and covering a land area of 66% and Pedon1b and 2b representing 6.4 hectares, 5.96 hectares and covering a land area of 53.3% and 47.41% were marginally suitable (S3) for mango cultivation due to severe limitation in soil physical characteristics (soil texture).

Based on the result above, its therefore recommended that none of the mapping units should be used for the cultivation of mango since it has a major limitation in soil physical characteristics (texture) which cannot be altered easily; however, the study area may however be used for cultivation of other crops for which it is best suited.

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