LAND SUITABILITY EVALUATION FOR TOMATO (*Solanum lycorpersicum*) CULTIVATION ON SOME SOILS OF IGUZAMA COMMUNITY IN EDO STATE

BY

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A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF SOIL SCIENCE AND LAND MANAGEMENT, UNIVERSITY OF BENIN, NIGERIA. IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF BACHELOR OF AGRICULTURE HONORS DEGREE IN SOIL SCIENCE AND LAND MANAGEMENT OF THE UNIVERSITY OF BENIN, BENIN CITY, NIGERIA.

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CERTIFICATION

This is to certify that this project titled "Land suitability evaluation for tomato cultivation on some soils of Iguzama community in Edo State'' was carried out by Jonathan NOMAHENUNUMWEN in accordance with the regulation of the award of Bachelor of Agriculture honours degree of the department of Soil Science and Land Management, Faculty of Agriculture, University of Benin, Benin City, Edo state, Nigeria.

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DEDICATION

I dedicate this research project to God Almighty for His abundant Mercy, Grace and all overwhelming love throughout the stay and successful completion of my bachelor's degree programme, and also to my wonderful and loving parents for all the love, care, prayers and provision.

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ABSTRACT

The study was carried out at Iguzama Community in Ovia North East Local Government area of Edo state, Nigeria, to evaluate some soils for tomato cultivation. The study area consisted of two sites; Site A, a 4 hectare land, and site B, a 12 hectare land. Soil survey was carried out by the rigid grid method at a detailed scale, using the rigid grid method which produced four mapping units. Each mapping units was represented by a pedon and each pedon was appropriately described. Soil samples were analysed using standard procedures. The result of the land evaluation revealed that pedon 1a (1.65ha) representing 38%, pedon 2a (2.64ha) which representing 62%, pedon 1b (6.4ha) representing 53% and pedon 2b (5.69ha) representing 47% of the study area were not suitable (N) for tomato cultivation due to severe limitations in soil physical characteristics and fertility. Limitations in soil physical characteristics cannot be amended, thus the study area should not be used for tomato cultivation; however, the study area may be used for other purpose(s) for which it is found suitable.

CHAPTER ONE

1. 0 INTRODUCTION

In recent years, there has been an increasing recognition of the necessity for systematic land suitability evaluations to optimize agricultural land use, enhance productivity, and mitigate environmental risks (Abubakar *et al*., 2018; Nwite *et al*., 2020). Land suitability refers to the degree to which a particular area of land is suitable for a specific land use or activity, taking into account its inherent properties and the requirements of the proposed land use (Römkens *et al*., 2018; Teye *et al*., 2020). It assesses how well the qualities of a land unit align with the requirements of a particular type of land use (FAO, 2007). Soil characterization and fertility evaluation are essential prerequisites for sustained crop production (Okonkwo and Nsor, 2015).

Land evaluation involves systematically assessing the suitability of land for various activities or purposes. It considers numerous factors such as soil attributes, climatic conditions, terrain, water resources, land cover, and socio-economic circumstances to determine the land's capability to support specific uses sustainably. The primary goal of land evaluation is to provide guidance for land use planning, decision-making, and resource management efforts aimed at optimizing land utilization while minimizing adverse environmental impacts (FAO, 2007; Mishra and Pandey, 2021).

Tomatoes (*Solanum lycopersicum*), formerly called *Lycorpersicum esculentus* belonging to the Solanaceae family, are of significant economic importance and contribute to food security in Nigeria, particularly in regions like Edo State where agriculture is crucial (Oyinbo *et al*., 2019). Despite their importance, challenges such as land degradation, climate variability, and inadequate infrastructure pose constraints to sustainable tomato cultivation, highlighting the critical link between tomato farming and land suitability.

Therefore, land suitability evaluation is essential for identifying suitable areas for tomato production, optimizing resource utilization, and minimizing environmental risks by assessing factors such as soil characteristics, climatic conditions, topography, and infrastructure accessibility (Oyinbo *et al*., 2019).

Agricultural cultivation without proper land suitability evaluation can have several negative impacts, including soil degradation, reduced productivity, environmental degradation, and economic losses (Okonkwo and Nsor, 2015), as neglecting this crucial step in the past has led to the inappropriate allocation of crops to areas ill-suited for their ecological needs, resulting in the failure of significant agricultural endeavors (Okunsebor *et al.,* 2022). As part of this study, the soil suitability for tomato cultivation in Iguzama community, Edo State, was evaluated.

OBJECTIVES OF THE STUDY

This study aims to:

i. Evaluate the suitability of two sites in Iguzama community for tomato cultivation
ii. Determine the areal extent of each suitability class identified through the evaluation process.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 LAND

Land refers to the physical surface of the Earth, encompassing various natural and man-made features such as soil, terrain, vegetation, water bodies, and infrastructure. It includes both terrestrial and aquatic environments, ranging from agricultural fields, forests, and grasslands to urban areas, wetlands, and bodies of water (FAO, 2013).

2.2 LAND EVALUATION

Land evaluation is a systematic process used to assess the suitability of land for specific purposes or land uses based on its inherent characteristics and constraints (Tefera, *et al*., 2022). It involves the analysis of various factors such as soil characteristics, topography, climate, hydrology, vegetation, and land management practices to determine the capability and limitations of the land for different uses (FAO, 2020). The primary objectives of land evaluation include maximizing land productivity, minimizing environmental impacts, and supporting sustainable development goals (Bouma, 2011). Land evaluation has applications in various sectors, including agriculture, forestry, urban planning, environmental management, and natural resource conservation. In agriculture, it helps identify suitable areas for crop cultivation, livestock grazing, and irrigation projects (Monteiro, *et al*., 2021). In forestry, it assists in selecting appropriate sites for afforestation, timber harvesting, and conservation reserves. In urban planning, it guides decisions regarding land zoning, infrastructure development, and recreational areas. In environmental management, it supports efforts to protect sensitive ecosystems, restore degraded land, and mitigate the impacts of climate change. Soil attribute is important for the overall performance of land and play a preponderant role in checking land quality, and has been used extensively by several authors to monitor land degradation (Wang *et al*., 2023; Senjobi and Ogunkunle, 2011).

2.3 MEHODS AND TECHNIQUES

Land evaluation involves the utilization of diverse methods and techniques to assess the suitability of land for various purposes (Li *et al*., 2023; Malczewski and J. 2004). Field surveys, laboratory analysis, remote sensing, geographic information systems (GIS), and mathematical modeling are key components in this process.

Field surveys

Field surveys entail direct assessments conducted on-site to gather primary data regarding soil, vegetation, and topographic features (Smith *et al*., 2023). These surveys provide valuable information about the physical attributes of the land and help in understanding its characteristics.

Laboratory analysis

Laboratory analysis plays a crucial role in land evaluation by examining soil samples to determine their physical, chemical, and biological properties (Smith *et al*., 2023). This analysis provides detailed insights into soil composition, fertility, and potential limitations for specific land uses.

Remote sensing techniques

Remote sensing techniques, such as satellite imagery and aerial photography, offer an efficient means of collecting data over large areas (Smith *et al*., 2023). These methods provide valuable information on land cover, land use, and land degradation, allowing for comprehensive assessments of land suitability. GIS technology facilitates the integration, analysis, and visualization of spatial data collected from various sources (Jones *et al*., 2021). By incorporating data from field surveys, laboratory analysis, and remote sensing, GIS enables the creation of suitability maps and spatial decision support systems, aiding in informed decision-making processes.

Mathematical modeling

Mathematical modeling techniques, such as suitability index models and multi-criteria decision analysis, are employed to quantify the relationships between land characteristics and suitability criteria (Triantafilis and McBratney, 2020). These models help in objectively evaluating the suitability of land for specific uses, taking into account various factors and constraints. Overall, the combination of field surveys, laboratory analysis, remote sensing, GIS, and mathematical modeling forms a comprehensive approach to land evaluation, providing valuable insights for land use planning and management.

2.4 FACTORS CONSIDERED IN LAND EVALUATION

Soil Characteristics: Soil properties such as texture, fertility, depth, drainage, and pH levels play a crucial role in determining the suitability of land for agriculture, forestry, or other uses (Seifu *et al*., 2018). Different crops and vegetation types require specific soil conditions for optimal growth and productivity.

Topography: The physical features of the land, including slope, aspect, elevation, and landform, influence its suitability for various purposes. Steep slopes may be unsuitable for agriculture but suitable for forestry, while flat areas may be suitable for cultivation but prone to waterlogging. (Asmamaw *et al*., 2022).

Climate: Climate factors such as temperature, rainfall, evaporation, and seasonality affect the suitability of land for agriculture, horticulture, and other activities. (Seif-Ennasr *et al*, 2020). Climate data help assess the risk of drought, frost, or waterlogging, which can impact land productivity.

Hydrology: The availability and quality of water resources, including surface water, groundwater, and water runoff, are critical considerations in land evaluation. Proper drainage and irrigation facilities are essential for agricultural land, while wetlands may require preservation for biodiversity conservation (Kingsford *et al*., 2023).

Vegetation: The existing vegetation cover provides valuable information about the ecological characteristics and potential land uses (Fisher *et al*., 2022). Land with natural vegetation may be suitable for conservation, while degraded land may require rehabilitation or restoration efforts.

Land Management Practices: Human activities such as land clearing, cultivation, grazing, and urban development influence land suitability (Kuenzer *et al*., 2023). Sustainable land management practices aim to enhance land productivity while minimizing environmental degradation and resource depletion.

2.5 LAND SUITABILITY

Land suitability refers to the appropriateness of a specific type of land for a defined purpose. It can be assessed either in its current state (Actual Land Suitability) or after potential improvements (Potential Land Suitability) (Kim *et al*., 2010; Rossiter, 1996). The classification of land suitability is described first, followed by an explanation of various interpretative classifications, including qualitative, quantitative, and suitability for current or potential uses (Bouma and Dent, 2009). In cases where certain parts of the area are not relevant for a particular use, such areas are indicated as "NR" (Not Relevant) on maps or tables.

Actual and Potential Land Suitability: Land evaluation systems differentiate between the actual suitability of land in its current condition and its potential suitability after improvements or management interventions. Assessing both actual and potential land suitability allows for strategic planning and investment decisions to enhance land productivity and sustainability over time (FAO, 2018).

2.6 CONCEPTS OF LAND SUITABILITY EVALUATION

The concepts of land evaluation systems encompass a range of principles and methodologies aimed at assessing the suitability of land for various purposes. These systems are designed to provide a structured framework for decision-makers, planners, and land managers to make informed choices regarding land use planning, resource allocation, and sustainable development (FAO, 2022). Here are some key concepts of land evaluation systems:

Qualitative and Quantitative Approaches

Qualitative approaches to land evaluation involve expert judgment and descriptive criteria to categorize land into suitability classes based on subjective observations (Biswas *et al*., 2020). On the other hand, quantitative methods utilize mathematical models, GIS, remote sensing, and statistical analyses to objectively quantify land suitability (García-Ruiz *et al*., 2021).

Qualitative

Qualitative methods in land evaluation rely on descriptive criteria and expert judgment to assess the suitability of land for crop cultivation. Bouma (2011) discusses the use of land capability classification systems, which categorize land into capability classes based on soil properties, slope, drainage, and erosion factors. The United States Department of Agriculture (USDA) developed one such system known as the Land Capability Classification (LCC) system, which provides a qualitative assessment of land suitability for agriculture (USDA, 1976).

Stocking and Peake (1992) highlight the importance of field assessments and participatory approaches in qualitative land evaluation. They emphasize the role of local knowledge and community engagement in identifying land constraints and opportunities for crop cultivation.

Quantitative Methods

Quantitative methods utilize mathematical models, geographic information systems (GIS), remote sensing, and statistical techniques to analyze spatial data and quantify land suitability. Van Ranst and Vanmechelen (2000) propose a methodological framework for soil suitability evaluation, which integrates soil properties, climate data, and land management practices. They advocate for a multi-criteria approach that considers multiple factors simultaneously to assess land suitability for different crops. McBratney *et al*. (2003) discuss digital soil mapping techniques, which utilize spatial interpolation methods and soil-landscape modeling to predict soil properties at unsampled locations. These methods enable the creation of high-resolution soil maps for use in land evaluation assessments. Land evaluation considers various factors, including soil characteristics, topography, climate, hydrology, vegetation, and land management practices (Van Ranst and Vanmechelen, 2000). These factors influence the capability and limitations of the land for different land uses, guiding decision-making processes in land use planning and management.

2.7 CLASSIFICATION SYSTEMS

Land evaluation systems frequently employ classification frameworks to organize land suitability assessments, categorizing land into suitability classes for specific land uses (Biswas *et al*., 2020). Common classifications include land capability classification systems, soil suitability classification systems, and environmental land suitability classification systems (García-Ruiz *et al*., 2021). Land evaluation systems commonly incorporate hierarchical structures to classify land suitability, which includes orders, classes, subclasses, and units, with each level offering increasing levels of detail (Biswas *et al*., 2020). Orders represent broad categories of suitability, while classes, subclasses, and units provide finer distinctions based on varying degrees of suitability, limitations, or management requirements (García-Ruiz *et al*., 2021). It is crucial to consider new land utilization types or potential suitability classifications if stipulated conditions are not met (Biswas *et al*., 2020). The indication of "conditional" should not be applied to land with uncertain interpretation or marginal suitability, as excessive use would complicate understanding by users and should be avoided (García-Ruiz *et al*., 2021). The outcomes of a land suitability evaluation typically encompass various types of information, the inclusion and extent of which depend on the scale and depth of the study (Biswas *et al*., 2020).

i. The contextual factors, including physical, social, and economic aspects, form the basis of the evaluation. This involves both data and assumptions (Perlaviciute *et al*., 2014).

ii. Descriptions of land utilization types or major land uses relevant to the area are provided. The level of detail and precision increases with the intensity of the study. (Perlaviciute *et al*., 2014; FAO, 2019).

iii. Maps, tables, and textual representations illustrate the suitability levels of land mapping units for each considered land use, along with diagnostic criteria. Evaluations are conducted separately for each land use type. (Smith *et al*., 2020; FAO, 2019)

iv. Management and improvement specifications are outlined for each suitable land utilization type concerning each land mapping unit. The level of detail increases with the study's intensity, ranging from general drainage needs to specific details and costs of drainage works. (FAO, 2019)

v. Economic and social analyses examine the consequences of various land use options considered. (FAO, 2019).

vi. The fundamental data and maps used for the evaluation are presented. This includes the suitability classification itself, as well as valuable information for users, which may be provided as appendices or background documentation (FAO, 2019).

vii. Information regarding the reliability of suitability estimates is provided, aiding planning decisions and guiding future improvements in land suitability classifications by identifying data weaknesses and areas warranting further investigation. (FAO, 2019).

Four categories of decreasing generalization are recognized: Land Suitability Orders, Classes, Subclasses, and Units (FAO, 2019). As shown in fig. 2.1

2.8 LAND SUITABILITY ORDERS

In the classification of Land Suitability Orders**,** two main categories are represented: Order S (Suitable) and Order N (Not Suitable). Order S indicates land suitable for sustained use without unacceptable risks, while Order N represents land with qualities that preclude sustained use for the intended purpose. (FAO, 2019)

Land Suitability Classes

Land Suitability Classes reflect degrees of suitability within Orders. The classes are numbered consecutively, with decreasing degrees of suitability within each Order. For example, within the Suitable Order, classes may include Highly Suitable (S1), Moderately Suitable (S2), and Marginally Suitable (S3). In contrast, within the Not Suitable Order, there are typically two classes: Currently Not Suitable (N1) and Permanently Not Suitable (N2) (FAO, 2019).

Table: 2.1 Structure of the suitability classification

S/N	Categories	Explanation
1	Land suitability Orders	Reflecting kinds of suitability
2	Land Suitability classes	Reflecting degrees of suitability within orders
3	Land suitability Subclasses	Reflecting kinds of limitation or main kinds of improvement measures required, within classes
4	Land suitability units	Reflecting minor differences in required management within sub classes

Source: FAO (2019)

Land suitability subclasses

Land suitability subclasses denote specific limitations, such as moisture deficiency or erosion hazard. They are designated by lowercase letters with mnemonic significance, such as S2m, S2e, and S3me. Class S1 does not have subclasses. The number of subclasses recognized and the chosen limitations vary depending on the classification's purpose. However, the use of high, medium, and low suitability classes without specific parameters can be impractical. Authors such as Choung (2007) and Nguyen (1996) have utilized limitation factors outlined in FAO (1976), represented by small alphabets, for their classifications.

Land Suitability Units

Land Suitability Units are subdivisions of a subclass and exhibit the same suitability level at the class level, along with similar limitations at the subclass level. However, these units vary in their production characteristics or minor management requirements, enabling detailed interpretation at the farm planning level. Each unit is denoted by Arabic numbers following a hyphen, such as S2e-1, S2e-2, and there is no set limit to the number of units recognized within a subclass.

Conditional Suitability may be applied in certain cases to simplify presentation, especially when small land areas within the survey area are unsuitable or poorly suitable for a particular use under specific management conditions. The term "conditional" indicates suitability after specific conditions are met. It is considered a phase of the Suitable Order and is represented by a lowercase letter "c" between the order symbol and the class number, for example, Sc2. The various classes is summarized diagrammatically in fig 2.3 and table 2.3

However, the use of Conditional Suitability should be avoided unless certain conditions are fulfilled: (FAO, 1976)

i. If the conditions are not met, the land is either unsuitable or belongs to the lowest suitable class.

ii. Suitability significantly increases (usually by at least two classes) when the conditions are met.

iii. The area of conditionally suitable land is minimal compared to the total study area.

The classification system aims to provide a systematic framework for assessing land suitability based on various factors, including technical feasibility, environmental considerations, and economic viability.

Table 2.2: Structure of land suitability classes and sub - classes

Land suitability Orders	Land suitability classes	Land suitability sub classes
S	S1 (Highly suitable) S2 (moderately suitable) S3 (Marginally suitable)	e.g. $S2t^0$ or S3 sl t^0 – temperature, sl = soil slope
N	N1 (currently not suitable) N2 (Permanently not suitable)	

On the basis of scope of suitability two types of classifications proposed by FAO framework (1976);

Table 2.3: Categories and description of suitability classes

Suitability class	Description
Class S1 Highly Suitable	Land having no significant limitations to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.
Class S2 Moderately Suitable	Land having limitations which in aggregate are moderately severe for sustained application of a given use; 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 appreciably inferior to that expected on Class S1 land.
Class S3 Marginally Suitable	Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified.
Class N1 Currently Not Suitable	Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner.
Class N2 Permanently Not Suitable:	Land having limitations which appear so severe as to preclude any possibilities Of successful sustained use of the land in the given manner.

2.9 TOMATO

Tomato is one of the most important vegetable crops in Nigeria, both in terms of consumption and economic value. As one of the most important vegetable crops in the country, tomatoes are cultivated extensively across various regions, contributing significantly to food security, dietary diversity, and economic development (Ezeh *et al*., 2019). In terms of nutrition, tomatoes are valued for their rich content of essential vitamins and minerals. They are particularly abundant in vitamin C, vitamin A, potassium, and antioxidants such as lycopene, which play crucial roles in maintaining overall health and preventing diseases (Oyinbo *et al*., 2018). In a country where malnutrition remains a persistent challenge, especially among vulnerable populations, including children and pregnant women, the availability of nutrient-rich crops like tomatoes is essential for addressing dietary deficiencies and promoting overall well-being (Adebayo *et al*., 2020). Beyond their nutritional benefits, tomatoes are a vital source of income and employment for millions of smallholder farmers across Nigeria. The cultivation of tomatoes provides livelihood opportunities in rural areas, where agriculture serves as the primary source of income for many households (Ezeh *et al*., 2019). The value chain associated with tomato production, including farming, transportation, processing, and marketing, creates employment opportunities at various stages, contributing to poverty reduction and rural development (Oyinbo *et al*., 2018).

Furthermore the tomato industry plays a crucial role in the country's agro-processing sector. Tomatoes are processed into a wide range of products, including sauces, purees, and pastes, which are staple ingredients in Nigerian cuisine and widely used in food preparation (Oyinbo *et al*., 2018). The processing of tomatoes adds value to the crop, extends its shelf life, and diversifies its usage, thereby enhancing its economic importance and contributing to the growth of the food processing industry.

Despite its significance, the tomato sector in Nigeria faces various challenges, including pests and diseases, inadequate infrastructure, post-harvest losses, and market fluctuations (Ezeh *et al*., 2019). Pests such as the tomato fruit borer and diseases like bacterial wilt and tomato yellow leaf curl virus pose significant threats to production, leading to yield losses and reduced profitability for farmers. Additionally, the lack of sufficient storage facilities and transportation infrastructure contributes to post-harvest losses, limiting the availability of fresh tomatoes in the market and affecting food security (Oyinbo *et al*., 2018).

Addressing these challenges requires concerted efforts from various stakeholders, including government agencies, research institutions, development organizations, and the private sector (Ezeh *et al*., 2019). Investments in research and development, extension services, and agricultural infrastructure are essential for improving productivity, reducing losses, and enhancing the competitiveness of the tomato value chain. Furthermore, policies that support smallholder farmers, promote agribusinesses, and facilitate access to markets and finance can contribute to the sustainable growth of the tomato sector and the overall agricultural economy in Nigeria (Oyinbo *et al*., 2018).

2.10 PHYSICAL CHARACTERISTICS

Tomato (*Solanum lycopersicum*) is a widely cultivated crop known for its adaptability to various soil and climatic conditions (Hanson and Hogue, 2020). Typically, tomato plants are characterized by their branching nature, spreading between 60 to 180 cm (24 to 72 inches), with some varieties exhibiting a compact and upright growth habit (Hanson and Hogue, 2020). The leaves of tomato plants are typically pinnately compound, hairy, and emit a strong odor, reaching lengths of up to 45 cm (18 inches). The flowers, which are yellow and pendant, typically measure about 2 cm (0.8 inches) in diameter and are clustered together. The fruit of the tomato plant, commonly referred to as berries, come in a range of colors including red, scarlet, and yellow, with some varieties exhibiting green and purple hues (Gupta *et al*., 2020).

They vary in size and shape, ranging from spherical to oval or elongated pear-shaped (Gupta *et al*., 2020). Each fruit contains multiple small seeds surrounded by a gelatinous pulp (Gupta *et al*., 2020).

2.11 AGRONOMIC PRACTICES

To mitigate production challenges and improve tomato yields, Nigerian farmers employ various agronomic practices tailored to local conditions. These practices include proper land preparation, seed selection, irrigation management, fertilizer application, pest and disease control, and post-harvest handling techniques (Oyewole *et al*., 2019). Integrated pest management (IPM) strategies, such as crop rotation, intercropping, and the use of resistant/tolerant varieties, are increasingly adopted to reduce reliance on chemical pesticides and mitigate pest resistance (Oluwasola *et al*., 2020).

2.12 SOIL REQUIREMENTS

Optimal soil conditions are essential for successful tomato cultivation. Studies emphasize the importance of well-drained, fertile soils with good moisture retention and high organic matter content (Pettygrove *et al*., 1999). While tomatoes exhibit moderate tolerance to pH variations, they thrive best in slightly acidic to neutral soils with a pH range of 5.5 to 7.5 (Pettygrove *et al*., 1999; Allemann and Young, 2008). Soil depth of at least 60 cm is acceptable, although deeper soils are preferred to support robust root development (Allemann and Young, 2008), Electrical Conductivity of the soil solution (ECE) of 2.5 dSm' (Bierhuizen and Ploeman, 1967).

2.13 CLIMATE AND ENVIRONMENTAL FACTORS

Temperature and humidity are critical factors influencing tomato growth and yield in Nigeria. Optimal temperature ranges between 23-27°C are conducive to healthy plant growth, while high temperatures can adversely affect fruit setting and development (Ibrahim, 1999). Additionally, relative humidity levels of 8-10% are desirable for optimal tomato production (Hussaini, 2012). However, excessive rainfall or prolonged dry spells can pose challenges to tomato cultivation, leading to yield losses and disease outbreaks.

2.14 CHALLENGES AND CONSTRAINTS

Despite its importance, tomato cultivation in Nigeria faces various challenges, including pest and disease pressure, inadequate infrastructure, and market fluctuations. Pests such as aphids, whiteflies, and nematodes, as well as diseases like bacterial wilt, fusarium wilt, and late blight, pose significant threats to tomato production (Ogbo *et al*., 2019). Moreover, poor post-harvest handling practices, limited access to credit and inputs, and inadequate storage facilities contribute to post-harvest losses and reduce farmers' profitability.

2.15 MITIGATION STRATEGIES

Efforts to improve tomato cultivation in Nigeria are underway, with initiatives focusing on enhancing agronomic practices, promoting sustainable production methods, and strengthening value chains. Adoption of improved varieties with disease resistance traits, coupled with training in good agricultural practices, can help mitigate production risks and enhance yields (Oyiga *et al*., 2020).

CHAPTER 3

3.0 MATERIALS AND METHODS

3.1 STUDY AREA

This study was conducted at Iguzama Community in Ovia North East Local Government area of Edo State, Nigeria. As shown in figures 1 and 3, the study area consists of two sites; Site A is a 4 hectare land which lies within latitude 6º24'30" N and 6º25'0"N; and Longitude 5º28'30"E and 5º29'0"E. Fig.3.1. Site B is a 12 hectare land laying within Latitude 6º24'40' N and 6º24'45"N; and Longitude 5º28'25"E and 5º28'35"E. The region is distinguished by a tropical climate with an annual average rainfall amount of 1900mm, mean annual temperatures ranging from 23°C to 37°C and mean annual relative humidity ranging from 89% in the morning (10.00 am) to 75% in the evening (4 pm), recorded over a period of 18years (NIFOR, 2018).The soils were formed from coastal plain sand parent material, a derivative of sedimentary rock that has undergone intense weathering process arising from high rainfall and temperature (Nigeria Geological Survey Agency, 2008). The topography is a terrace, with a slope range of 2.59 - 6.09% in Site A; and 0.2 - 5.9% in Site B.

3.2 FIELD WORK

Soil survey was conducted on site A (4ha) and site B (12 ha) using the rigid grid systematic survey method at a detailed scale. Traverses were cut at intervals of 100m apart; along the traverses, observation points (100 m apart for site A and 50 m apart for site B) were located using a GPS (global position system), Site A had eight observation points while Site B had twelve. Soil samples were examined at depth intervals of 30cm, 60cm, 90cm and 120cm respectively using a soil auger. The morphological properties which include texture by feel, colour, vegetation and slope position, were studied on the field and recorded on their respective proforma sheet. Mapping units were delineated based on similarities in properties and characteristics; two mapping units were delineated in each study site. Pedons measuring 2 m x 2 m x 2 m in dimension were sunk at representative points in each mapping unit, and described appropriately according to the guidelines of FAO (2006). The observed horizons were sampled from below to the top, collected in polythene bags and labeled properly for laboratory analysis. Fig. 2 and 4.

3.3 LABORATORY ANALYSIS

The soil samples obtained from each layer were air dried and sieved through a 2mm sieve. Particle size analysis was determined using the Hydrometer method developed by Gee and Or (2002). Organic matter content was determined through hydrogen peroxide treatment and dispersion with sodium hexa-metaphosphate following the guidelines established by the International Institute for Tropical Agriculture (IITA) in 1979. Available phosphorus levels were assessed using the Bray-II method devised by Olsen and Sommers (1982). Soil pH was measured using a glass electrode pH-meter in a mixture of soil and water. Exchangeable bases (sodium, potassium, calcium, magnesium) were extracted using normal neutral ammonium acetate buffered at pH 7.0 with sodium and potassium quantified using a flame photometer and calcium and magnesium determined using atomic absorption spectro-photometry. Total nitrogen content was determined using the Macro-Kjeldahl method introduced by Bremner and Mulvaney (1982). Exchangeable acidity (H^+ and $Al^{3+)}$ was assessed via the Titration method developed by Anderson and Ingram (1993). Organic carbon content was determined using the Walkley-Black method as outlined by Page (1982). The Effective Cation Exchange Capacity (ECEC) was calculated by summing up the exchangeable bases and exchangeable acidity according to Tan (1996). Base saturation was computed by dividing the sum of exchangeable bases (sodium, potassium, calcium, and magnesium) by the ECEC and then multiplying the quotient by 100. ESP was also determined. Equation 1.

3.4 LAND SUITABILITY EVALUATION

Land suitability evaluation was conducted using limitation method. The limitation method relied on the FAO (1976) framework for rain-fed agriculture and guidelines established by Sys (1985), as modified by Magaji *et al*. (2020) for tomato cultivation. The suitability class assigned to a pedon (aggregate suitability) was determined by its most limiting (poorest) characteristic, following the principle of the law of minimum, which states that performance is always determined by the least favorable factor or nutrient supply (FAO, 1984).

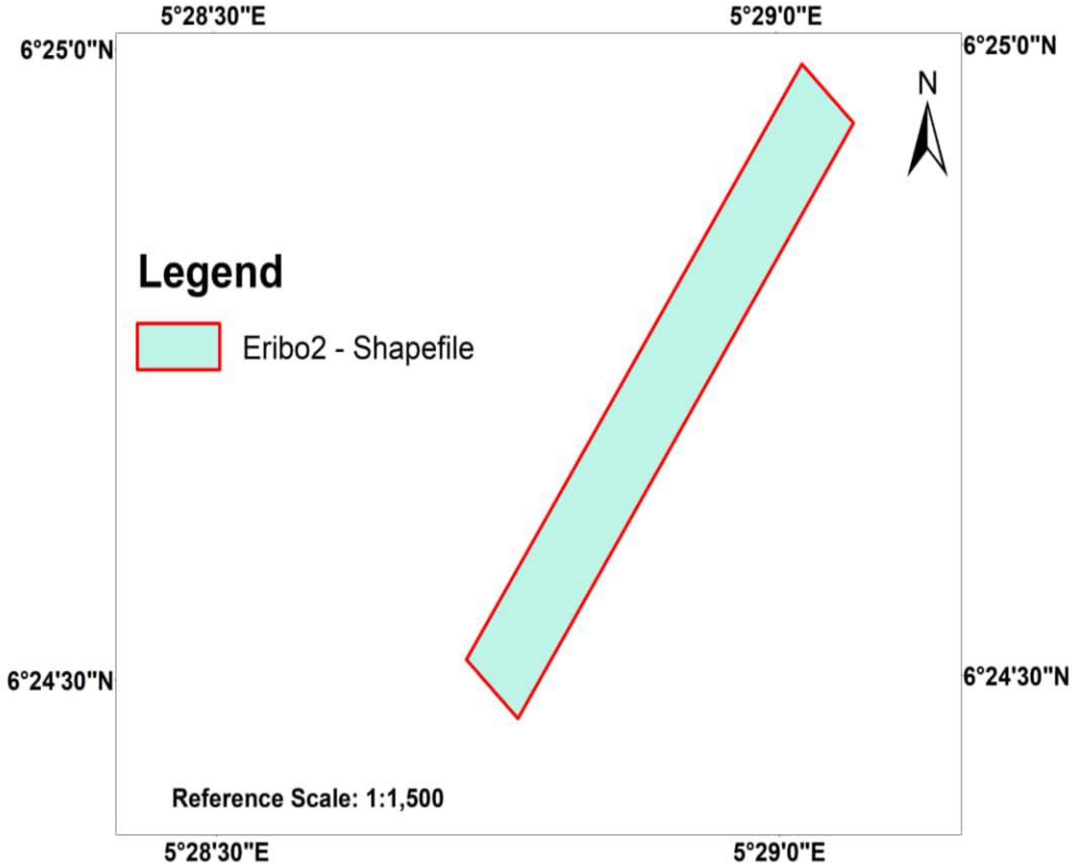

Fig 3.1: Location map of Iguzama Site A

Fig 3.2: Google imagery of Site A with auger point

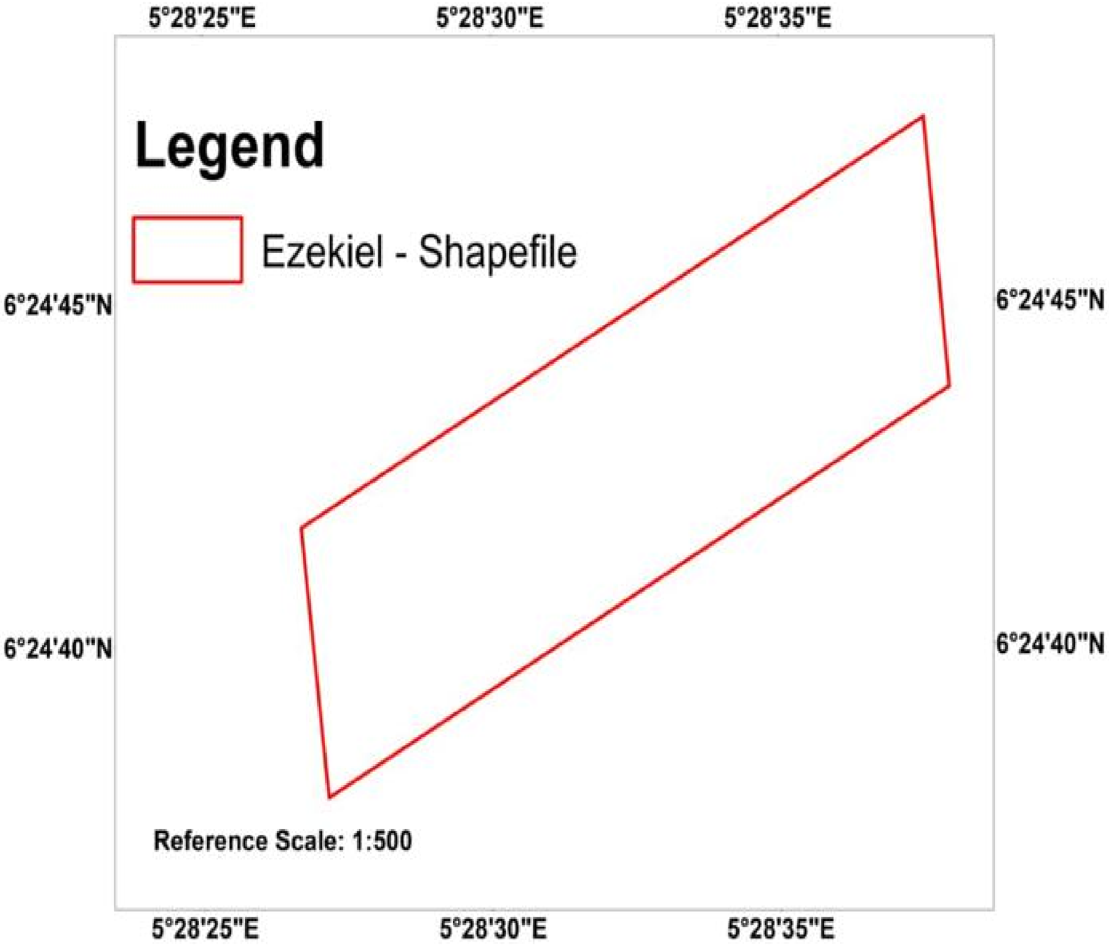

Fig 3.3: Location map of Iguzama Site B

Fig 3.4: Google imagery of Iguzama Site B with auger points

$$ECEC = (Ca + Mg + Na + K) + (H^+ + AL^{3+})$$

$$ESP\ (\%) = \frac{\text{Exchangeable Sodium}}{CEC\ (NH_4OAc)} \times 100$$

$$\text{Base Saturation}\ (\%) = \frac{\text{Base Cations}}{CEC} \times 100$$

Equation 3.1: ECEC, ESP And Base Saturation Determination

Table 3.1: Requirements for the growth of tomato

			Suitability rating			
Land Quality		**Unit**	**S1**	**S2**	**S3**	**N**
Climatic (c)	Mean temperature	ºC	25 - 28	29 – 32	33- 36	<15,
				20-24	15-19	>36
	Total rainfall	mm	600-750	500-600,	450-500,	<450,
				750-1000	>1000	>10000
Topography (t)	Slope	%	1-3	3-5	5-10	>10
Wetness (w)	Soil drainage	class	Well-drained	Moderate	Imperfect	poor
Soil physical	Texture	Class	Sl, l, cl, scl	Sicl, sic, sc, c	C	Ls, s
Properties (s)	Soil depth	Cm	>75	50-75	25-50	<25
Fertility	pH	1:2:5	6.0-7.0	5.0-5.9,	<5, >8.5	
				7.1-8.5		
	OC	%	>1	0.8-1	0.4-0.5	<0.4
	N	%	>2	1.5-2	1.0-1.4	<1
	P	%	>20	15-20	10-15	<10
	K	%	>0.3	0.2-3	0.15-0.2	<0.15
Soil toxicity (n)	Salinity (EC)	dsm^{-1}	<4	4.8	8-16	>16
	Sodicity (ESP)	%	<15	15-20	19-25	>25

S1 = Highly suitable (100-75%), S2 = Moderately suitable (75-50%), S3 = Marginally suitable (49-25%), N = Not suitable (24-0%).

Source: Magaji *et al.* (2020)

CHAPTER FOUR

4.0 RESULT AND DISCUSSION

4.1 LAND SUITABILITY EVALUATION (LSE)

The land suitability assessment employed the traditional limitation approach, where each Pedon was categorized into suitability classes based on its characteristics compared to the established criteria for Tomato cultivation. The overall suitability class was determined by identifying the most limiting characteristics among the Pedons. Parameters considered for land quality evaluation included rainfall, mean annual temperature, slope, wetness, drainage, and soil characteristics such as texture, pH, depth, and fertility indicators like CEC, base saturation, and organic matter. The results were analyzed on a Pedon-by-Pedon basis, discussing their characterization and suitability for tomato production following the guidelines outlined by Sys (1985) as adapted by Magaji *et al.* (2020).

PEDON 1a

CHARACTERIZATION

The physical and chemical properties of Pedon 1a soil were analyzed across various depth levels. *Table 4.1.* The analysis includes pH, Electrical Conductivity (EC), organic carbon, organic matter, total nitrogen, available phosphorus, exchangeable bases (Ca, Mg, Na, K), exchange acidity (Al, H), Effective Exchangeable Cation Capacity (ECEC), Base Saturation (BS), and particle size distribution (sand, silt, clay).

Physical and Chemical Properties

pH ranged from 5.02 to 6.22. Highest at 0 – 13cm (6.22) and lowest at 121 – 180cm (5.02), decreasing irregularly down the profile. **Electrical Conductivity (EC)** ranged from 65.10 μsm^{-1} to 109.70μsm^{-1}. Highest at 0 – 13cm (109.70μsm^{-1}) and lowest at 121 – 180cm (65.10μsm^{-1}), decreasing regularly down the profile. **Organic Carbon** ranged from 1.30gkg^{-1}

to 23.13gkg^{-1} Highest at 0 – 13cm (23.13gkg^{-1}) and lowest at 121 – 180cm (1.30gkg^{-1}), decreasing regularly down the profile. **Organic Matter** ranged from 2.25 to 39.87gkg^{-1}. Highest at 0 - 13cm (39.87gkg^{-1}) and lowest at 121 – 180cm (2.25gkg^{-1}), decreasing regularly down the profile**. Total Nitrogen** ranged from 0.10gkg^{-1} to 1.93gkg^{-1}. Highest at 0 – 13cm (1.93gkg^{-1}) and lowest at 121 – 180cm (0.10gkg^{-1}), decreasing down the profile. **Available Phosphorus** ranged from 1.72mgkg^{-1} to 44.47mgkg^{-1}. Highest at 0 -13cm (44.47mgkg^{-1}) and lowest at 121 – 180cm (1.72mgkg^{-1}), decreasing down the profile.

Exchangeable Bases: Ca, Mg, Na, and K were all higher at 0 – 13cm. Ca ranged from 0.55cmolkg^{-1} to 2.58cmolkg^{-1}, Mg ranged from 0.08cmolkg^{-1} to 0.38cmolkg^{-1}, Na ranged from 0.29cmolkg^{-1} to 0.34cmolkg^{-1}, and K ranged from 0.17 to 0.19cmolkg^{-1}.

Exchange Acidity

Aluminum ranged from 0.00 to 0.82cmolkg^{-1}. Highest at 121cm – 180cm, increasing down the profile. Hydrogen ion ranged from 0.1cmolkg^{-1} to 0.16cmolkg^{-1}, increasing irregularly down the profile.

Effective Exchangeable Cation Capacity (ECEC)

ECEC ranged from 2.06cmolkg^{-1} to 3.58cmolkg^{-1}. Highest at 0 – 13cm and lowest at 121cm – 180cm, decreasing with depth.

Base Saturation (BS) ranged from 52.52 to 97.21%., highest at the surface and lowest at 121 – 180cm, decreasing down the profile.

Particle Size Distribution

Sand ranged from 830 to 960gkg^{-1}, highest at the surface, decreasing down the profile.

Silt ranged from 10 to 30gkg^{-1} highest at 121 -180cm and lowest at 0 – 13cm, increasing down the profile.

Clay ranged from 30 to 140gkg^{-1}. Highest at 121 – 180cm and lowest at 0 – 13cm, increasing down the profile.

Textural Class: The textural class ranged from Sand (S) to Loamy Sand (LS).

zon	pH	EC	Org. C	Org.	Total N.	Avail P	Ca	Mg	Na	K	H	Al	ECEC	CEC	ECECCL	BS	SAND	SILT

th				matter											AY			
	H20	µS/cm	**gkg-1**		**gkg-1**	**mgkg1**	→	→	→	**cmolkg-1**	←	←	←	←	→	**gkg-1**	←	
3	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	10.0
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	20.0
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	40.0
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	30.0
-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	30.0
	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	26.0
	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	11.4
	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	43.9
	LV	MV	HV	HV	HV	HV	HV	HV	MV	HV		HV	MV	MV	HV	HV	LV	HV

Table 4.1: PHYSICAL AND CHEMICAL PROPERTIES OF PEDON 1a

4.2 SUITABLITY CLASSIFICATION OF PEDON 1a FOR TOMATO CLASSIFICATION

Based on the guidelines provided by Magaji *et al.* (2020), an evaluation of Pedon 1a for tomato production was conducted, considering various parameters.

CLIMATE

The rainfall amount in the study area was recorded at >1000mm (1900), classifying it as S3 (marginally suitable) according to Magaji *et al.* (2020). The mean annual temperature falls within the range of 30°C, placing Pedon 1a in suitability class S2 (moderately suitable) for tomato cultivation.

TOPOGRAPHY

Pedon 1a exhibits topography ranging from 2.59% to 6.09%, placing it in class S3 (marginally suitable) for tomato cultivation based on the guidelines provided.

WETNESS

The well-drained nature of the study area qualifies Pedon 1a as S1 (highly suitable) according to Magaji *et al.* (2020).

SOIL PHYSICAL CHARACTERISTICS

The soil texture varies from sand (S) to loamy sand (LS), placing Pedon 1a in suitability class N(s) (not suitable) for tomato cultivation. However, the depth of Pedon 1a being than 75cm qualifies it for suitability class S1 (highly suitable) according to the guidelines.

FERTILITY CHARACTERISTICS

pH was between 5.02 – 6.22, this rated the pedon 1a as S2 (moderately suitable) as stated by Magaji *et al.* (2020). The organic carbon ranged from 0.13g/kg – 2.3g/kg, this rated pedon 1a as S2. The total Nitrogen was <1% which rated the pedon N(f). The available phosphorus (P) was <10%, hence pedon 1a was rated as N(f). Potassium (K) was <0.15%, and this also rated the pedon as N(f).

SOIL TOXICITY

The salinity (EC) was 7.7ds/m which qualifies Pedon 1a as S2 while the Sodicity (ESP) was 16.9%, rating the pedon as S2.

AGGREGATE SUITABILITY CLASS

Current: On current suitability ratings, Pedon 1a (1.65ha) representing 38% of the study area was not suitable [N(s, f)] for tomato cultivation because of limitations in soil physical characteristics and fertility 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.

Potential: Potential suitability rating was not suitable [N(s)] for tomato cultivation due to major limitations in soil physical characteristics. The suitability evaluation for pedon 1a is summarized in *Table 4.2*

Table 4.2: Tomato suitability evaluation in pedon 1a

Land Characteristics	Suitability
CLIMATE (c)	
Mean annual Rainfall (mm)	S3 (1900)
Mean annual temp (°C)	S2 (30°C)
TOPOGRAPHY (t)	
Slope	S3 (2.59 – 6.09)
Wetness(w)	
Drainage	S1 (Well drained)
SOIL PHYSICAL CHARACTERISTIC (s)	
Soil depth (cm)	S1 (>75)
Texture / Structure	N(S – Ls)
FERTILITY (f)	
pH	S2 (5.02 – 6.22)
Organic Carbon	S2 (0.13 – 2.3)
Total Nitrogen (%)	N(f) 0.01 – 0.19
Phosphorus (P) (%)	N(f) 0.17 – 4.45
Potassium (K) (%)	N(f) 0.017 – 0.019
SOIL TOXICITY	
Salinity (EC) (ds/m)	S2 (7.7)
Sodicity (ESP) (%)	S2 (16.9)
AGGREGATE SUITABILITY CLASS	
Current	N(s, f)
potential	N(s)
Size (ha)	1.65

4.3 PEDON 2a

CHARACTERIZATION

The physical and chemical properties of pedon 1b are presented in *Table 4.4.* The soil pH ranged from 5.66 to 6.14, with the highest pH recorded at 0 – 15cm depth and the lowest at 127 – 169cm depth. pH values decreased down the profile. The Electrical Conductivity (EC) ranged from 25.50µsm^{-1} to 97.80µsm^{-1}, highest at 0 – 15cm and lowest at 127 – 169cm depth, decreasing regularly down the profile. The value of the organic carbon ranged from 2.44gkg^{-1} to 14.01gkg^{-1}, highest at 0 – 15cm and lowest at 127 – 169cm depth, decreasing regularly down the profile.

The organic matter value ranged from 4.21gkg^{-1} to 24.15gkg^{-1}, highest at 0 – 15cm and lowest at 127 – 169cm depth, with a regular decrease down the profile. The total Nitrogen ranged from 0.19 – 1.17gkg^{-1}. The Total Nitrogen was highest (1.17gkg^{-1}) at the depth of 0 – 15cm while it was lowest (0.19gkg^{-1}) at the depth of 127 – 169cm, the Total nitrogen decreased down the profile. The available phosphorus ranged from 2.38 – 13.14mgkg^{-1}. The Available phosphorus was highest (13.14mgkg^{-1}) at the depth of 0 – 15cm while it was lowest (2.38mgkg^{-1}) at a depth of 127 – 169cm. The Available phosphorus decreased down the profile.

The Exchangeable Bases**:** Ca, Mg, Na and K are all higher at the depth of 0 – 15cm. Ca ranged from 0.97 – 1.70cmolkg^{-1}. The Ca value was highest (1.70cmolkg^{-1}) at the depth of 0 – 15cm and lowest (0.97cmolkg^{-1}) at a depth of 127 – 169cm. Mg ranged from 0.18 – 0.25. The mg value was highest (0.25cmolkg^{-1}) at the depth of 0 – 15cm while it was lowest (0.18cmolkg^{-1}) at a depth of 127 – 169cm. The Mg values decreased down the profile. The Sodium content ranged from 0.19 – 0.43cmolkg^{-1}). The Sodium value was highest (0.43cmolkg^{-1}) at the depth of 0 – 15cm while it was lowest 0.19cmolkg^{-1} at the depth of 127 – 169cm. The Sodium value decreased regularly down the profile. The Potassium value which ranged from 0.01 – 0.29cmolkg^{-1} decreased down the profile. The Potassium value was highest (0.29cmolkg^{-1}) at the depth of 0 – 15cm while it was lowest (0.01cmolkg^{-1}) at the depth of 127 – 169cm.

Exchange Acidity: The Aluminum values ranged from 0.00 – 0.70cmolkg^{-1}. The Aluminum value was highest (0.70cmolkg^{-1}) at a depth of 127 – 169cm while it was lowest (0.00cmolkg^{-1})

5	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	44.0
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	40.0
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	20.0

at a depth of 0 – 15cm. Aluminum was generally lower at the top soil and increased down the profile. The hydrogen ion which was 0.1cmolkg^{-1} at the depth of (0 – 15cm) increased down the soil depth. The Hydrogen ion was highest (0.16cmolkg^{-1}) at a soil depth of 127 – 169cm and lowest (0.1cmolkg^{-1}) at a depth of 0 – 15cm.

The Exchangeable Cation Capacity (ECEC): values ranged from 2.21cmolkg^{-1} to 2.78cmolkg^{-1}. The ECEC values decreased with increase in soil depth. ECEC was highest (2.78cmolkg^{-1}) at a depth of 0 – 15cm while it was lowest (2.21cmolkg^{-1}) at a depth of 127 – 169cm. The Base Saturation (BS) values of the soil ranged from 61.09gkg^{-1} to 75.68gkg^{-1}. The Base saturation was highest (75.68gkg^{-1}) at the surface and lowest (61.09gkg^{-1}) at the depth of 127 – 169cm. The base saturation decreased down the profile.

Particle Size Distribution: Sand values ranged from 680gkg^{-1} to 924gkg^{-1}; the value was highest (924gkg^{-1}) at the surface and decreased down the profile. The silt values ranged 10gkg^{-1} to 44gkg^{-1}, the slit value was highest (44gkg^{-1}) at a depth of 0 – 15cm while it was lowest (10gkg^{-1}) at a depth of 127 – 169cm. The silt values decreased down the profile. The percentage clay values ranged from 310 – 32g/kg. The clay value was highest (310gkg^{-1}) at the depth of 127 – 169cm and lowest (32gkg^{-1}) at a depth of 0 – 15cm. The clay value increased down the profile. **Textural class:**

The textural class ranged from Sand (S), Sandy Loam (SL) to Sandy Clay Loam (SCL).

Table 4.4: PHYSICAL AND CHEMICAL PROPERTIES OF PEDON 2a

Horizon depth (cm)	pH H20	EC μS/cm	Org. C gkg-1	Org. matter	Total N. gkg-1	Avail P mgkg1	Ca	Mg	Na	K	H	Al	ECEC	CEC	ECECCLAY	BS	SAND	SILT
							cmolkg-1 →					←			→	gkg-1	←	
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	20.0[illegible]
[illegible]160	5.66	25.50	2.44	4.21	0.19	2.18	0.97	1.18	0.19	0.01	0.16	0.70	2.21	163.42	[illegible]	[illegible]	680.00	[illegible]
	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	26.8[illegible]
	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
	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	54.2[illegible]
	LV	HV	HV	HV	HV	HV	HV	HV	HV	HV	MV	LV	MV	MV	HV	LV	LV	HV

4.4 SUITABLITY CLASSIFICATION OF PEDON 2a FOR TOMATO CLASSIFICATION

Base on the guidelines in Magaji *et al.* (2020), the following parameter were used in the evaluation of pedon 1b for tomato production.

CLIMATE

Among the climate parameter the most important to crop production is the amounts and distribution of rainfall. From the result obtained, the amount of rainfall in the study area was 1900mm (NIFOR, 2013). This according to Magaji *et al.* (2020) falls in the suitability class S3. The mean annual temperature ranges from 30^{0}C in the study site; this placed the pedon in the suitability class S2 (moderately suitable).

TOPOGRAPHY

The topography of pedon 2a ranges from 0.79 – 2.6% and falls into class S1 **(**Highly suitable) for tomato cultivation based on the guideline Magaji *et al.* (2020).

WETNESS

The study area of pedon 2a was well drained. This qualified pedon 2a as S1 (highly suitable) according to Magaji *et al.* (2020).

SOIL PHYSICAL CHARACTERISTICS

The soil texture ranged from sand (S), sandy loam (SL) to sandy clay loam (SCL) and this placed pedon 2a in suitability class N (not suitable) for the cultivation of tomato. The depth of pedon 2a was >75cm which according to the guideline qualifies the pedon to be in suitability class S1 (highly suitable) for tomato cultivation.

FERTILITY CHARACTERISTICS

The pH was between 5.66 – 6.14, this rated the pedon as S2 (moderately suitable) as stated by Magaji *et al.* (2020). The organic carbon ranged from 0.24 – 1.40%, this rated the pedon as

N(f). The total Nitrogen (N) ranged from 0.019 – 0.12% placing pedon 2a as N(f). The available phosphorus (P) was <10%, hence the pedon was rated N(f). Potassium was <0.15%, and this also rated the pedon as not suitable N(f).

SOIL TOXICITY

The salinity (EC) was 4.7ds/m which qualifies Pedon 2a as S2, while the Sodicity (ESP) was 18.18%, rating pedon 2a as S2.

AGGREGATE SUITABILITY CLASS

Current: The evaluation of the land characteristics and the current aggregate rating of Pedon 2a (2.64ha) representing 62% of the study area was not suitable [N(s, f)] for tomato cultivation because of major limitations in fertility and soil physical characteristics of the pedon.

Potential: Potential suitability rating was not suitable [N(s)] for tomato cultivation due to major limitations in soil physical characteristics. The suitability evaluation for pedon 2a is summarized in *Table 4.5*

Table 4.5: Tomato suitability evaluation in pedon 2a

Land Characteristics	Suitability

CLIMATE (c)	
Mean annual Rainfall (mm)	S3 (1900)
Mean annual temp (^oC)	S2 (30^oC)
TOPOGRAPHY (t)	
Slope	S1 (0.79 – 2.6)
Wetness(w)	
Drainage	S1 (Well drained)
SOIL PHYSICAL CHARACTERISTIC (s)	
Soil depth (cm)	S1 (>75)
Texture / Structure	N (S – Ls)
FERTILITY (f)	
pH	S2 (5.66 – 6.14)
Organic carbon (%)	N (0.24 – 1.4)
Total Nitrogen (%)	N(f) 0.019 – 0.117
Phosphorus (P) (%)	N(f) 0.24 – 1.3
Potassium (K)	N(f) 0.001 – 0.029
SOIL TOXICITY	
Salinity (EC)	S2 (4.7ds/m)
Sodicity (ESP) (%)	S2 (18.18%)
AGGREGATE SUITABILITY CLASS	
Current	N(s, f)
potential	N(s)
Size (ha)	2.64

4.5 PEDON 1b

CHARACTERIZATION

The physical and chemical properties of pedon 2a are presented in *Table 4.6.* The soil pH ranged from 5.26 to 6.38. The pH was highest (6.38) at the depth of 0 – 11cm while it was lowest (5.38) at the depth 101 – 175cm. The pH values decreased down the profile. The value of Electrical Conductivity (EC) ranged from 33.80μsm^{-1} – 61.90μsm^{-1}. The EC was highest (61.90μsm^{-1}) at the depth of 0 – 11cm while EC was lowest (33.80μsm^{-1}) at the depth of 101 – 175cm. The EC decreased regularly down the profile. The organic carbon ranges from ranged from 1.71gkg^{-1} – 9.12gkg^{-1}. The organic carbon was highest (9.12gkg^{-1}) at the depth of 0 – 11cm, while the organic carbon was lowest (1.71gkg^{-1}) at the depth of 101 – 175cm. The organic carbon decreased regularly down the profile. The organic matter ranged from 2.95 – 15.72gkg^{-1}. The organic matter was highest (15.72gkg^{-1}) at the depth of 0 – 11cm while the organic matter was lowest (2.95gkg^{-1}) at the depth of 101 – 175cm, there was a regular decreased down the soil profile. The total Nitrogen ranged from 0.15 – 0.76gkg^{-1}. The Total Nitrogen was highest (0.76gkg^{-1}) at the depth of 0 – 11cm while it was lowest (0.15gkg^{-1}) at the depth 101 – 175cm, the Total nitrogen decreased down the profile. The available phosphorus ranged from 2.46 – 5.61mgkg^{-1}. The Available phosphorus was highest (5.61mgkg^{-1}) at the depth of 0 – 11cm while it was lowest (2.46mgkg^{-1}) at a depth of 101 – 175cm. The Available phosphorus decreased down the profile.

The Exchangeable Bases

Ca, Na, and K, exhibit distinct patterns within the soil profile. At a depth of 0 – 11cm, Ca, Na, and K are all higher, while Mg shows a higher concentration at 101 – 175cm. Ca ranges from 0.50 to 1.60cmolkg^{-1}, with the highest value (1.60cmolkg^{-1}) at 0 – 11cm and the lowest (0.50cmolkg^{-1}) at 101 – 175cm. Mg ranges from 0.25 to 0.20cmolkg^{-1}, peaking at 101 – 175cm (0.25 cmolkg^{-1}) and lowest at 0 – 11cm (0.20cmolkg^{-1}). Sodium content ranges from 0.19 to 0.24cmolkg^{-1}, with the highest (0.24cmolkg^{-1}) at 0 – 11cm and the lowest (0.19cmolkg^{-1}) at 101

– 175cm, indicating a regular decrease down the profile. Potassium, ranging from 0.01 to 0.08cmolkg^{-1}, decreases down the profile, with the highest value (0.08cmolkg^{-1}) at 0 – 11cm and the lowest (0.01cmolkg^{-1}) at 101 – 175cm.

Exchange Acidity

The Aluminum values ranges from 0.08 – 1.12cmol/kg. The Aluminum value was highest (1.12cmolkg^{-1}) at a depth 101 – 175cm while it was lowest (0.08cmolkg^{-1}) at a depth of 0 – 11cm. Aluminum was generally lower at the top soil and increased down the profile. The hydrogen ion which was 0.04cmolkg^{-1} at the depth of (0 – 11cm) increased down the soil depth. The Hydrogen ion was highest (0.16cmolkg^{-1}) at a soil depth of 101 – 175cm and lowest (0.04cmolkg^{-1}) at a depth of 0 – 11cm.

The Effective Exchangeable Cation Capacity (ECEC)

ECEC values ranged from 2.23cmol/kg to 2.24cmol/kg. The ECEC values decreased with increase in soil depth. ECEC was highest (2.24cmolkg^{-1}) at a depth of 0 – 11cm while it was lowest (2.23cmolkg^{-1}) at a depth of 101 – 175cm. The Base Saturation (BS) values of the soil ranges from 42.71gkg^{-1} to 94.64gkg^{-1}. The Base saturation was highest (94.64gkg^{-1}) at the surface and lowest (42.71gkg^{-1}) at the depth of 101 – 175cm. The base saturation decreased down the profile.

Particle size distribution:

Sand values ranges from 800gkg^{-1} to 900gkg^{-1}; the value was highest (900gkg^{-1}) at the surface and decreased down the profile. The silt values ranges from 10gkg^{-1} to 20gkg^{-1}, the slit value was highest (20gkg^{-1}) at a depth of 0 – 11cm while it was lowest (10gkg^{-1}) at a depth of 101 – 175cm. The silt values decreased down the profile. The percentage clay values ranges from 190

– 89gkg^{-1}. The clay value was highest (190gkg^{-1}) at the depth of 101 – 175cm and lowest (80gkg^{-1}) at a depth of 0 – 11cm. The clay value increased down the profile.

Textural class: the textural class ranges from Sand (S), loamy sand (LS) to Sandy Loam (SL).

Table 4.6: PHYSICAL AND CHEMICAL PROPERTIES OF PEDON 1b

izon oth	**pH**	EC	**Org. C**	**Org. matter**	**Total N.**	**Avail P**	**Ca**	**Mg**	**Na**	**K**	**H**	**Al**	**ECE C**	**CEC**	**ECECC LAY**	**BS**	**SAND**	**SIL**
cm)	**H20**	µS/cm	**gkg^{-1}**		**gkg^{-1}**	**mgkg^{1}**	→		→	**cmolkg^{-1}**	←				→	**gkg^{-1}** ←		
1	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	20.0
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	20.0
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	10.0
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	15.0
-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	10.0
	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	15.0
	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
	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	33.3
	LV	MV	HV	HV	HV	HV	HV	MV	MV	HV	HV	HV	LV	LV	HV	HV	LV	MV

4.6 SUITABLITY CLASSIFICATION OF PEDON 1b FOR TOMATO CLASSIFICATION

Base on the guidelines in Magaji *et al.* (2020), the following parameter were used in the evaluation of pedon 2a for tomato production.

CLIMATE

Among the climate parameter the most important to crop production is the amounts and distribution of rainfall. From the result obtained, the amount of rainfall in the study area was 1900mm (NIFOR, 2013). This according to Magaji *et al.* (2020) falls in the suitability class S3 (marginally suitable). The mean annual temperature ranges from 30^0C in the study site; this placed the pedon in the suitability class S2 (moderately suitable).

TOPOGRAPHY

The topography of pedon 2a ranged from 0.2 – 2.1% and falls into class S1 **(**Highly suitable) for tomato cultivation based on the guideline Magaji *et al.* (2020),

WETNESS

The study area of pedon 1b had no flooding problem and it is well drained. This qualified the pedon as S1 (highly suitable) according to Magaji *et al.* (2020),

SOIL PHYSICAL CHARACTERISTICS

The soil texture ranged from sand (S), sandy loamy sand (LS) to sandy loam (SL) and this placed pedon 1b in suitability class N (not suitable). The depth of pedon 1b was >75cm which according to the guideline qualifies the pedon to be in suitability class S1 (highly suitable) for tomato cultivation.

FERTILITY CHARACTERISTICS

pH was between 5.26 – 6.38, this rated the pedon as S2 (moderately suitable). The organic carbon ranged from 0.1 – 0.9gkg^{-1}, this rated the pedon as S3. The total Nitrogen (N) ranged from 0.015 – 0.076% which rated the pedon N(f). The available phosphorus (P) was <10%, hence the pedon was rated N(f), (not suitable). Potassium (K) was <0.15%, and this also rated the pedon as not suitable N(f).

SOIL TOXICITY

The salinity (EC) was 4.47dsm^{-1} which rated the pedon S2 while the Sodicity (ESP) was 15.42%, the pedon is rated S3.

AGGREGATE SUITABILITY CLASS

Current: On current suitability ratings, Pedon 1b (6.4ha) representing 53% of the study area was not suitable [N(s, f)] for tomato cultivation because of limitations in soil physical characteristics and fertility characteristics.

Potential: Potential suitability rating was not suitable [N(s)] for tomato cultivation due to major limitations in soil physical characteristics. The suitability evaluation for pedon 1b is summarized in Table 4.7

Table 4.7: Tomato suitability evaluation in pedon 1b

Land Characteristics	Suitability
CLIMATE (c)	
Mean annual Rainfall (mm)	S3 (1900)
Mean annual temp (°C)	S2 (30°C)
TOPOGRAPHY (t)	
Slope (%)	S1 (0.2 – 2.1)
Wetness (w)	
Drainage	S1 (Well drained)
SOIL PHYSICAL CHARACTERISTIC(s)	
Soil depth (cm)	S1 (>75)
Texture / Structure	N (S – Ls)
FERTILITY (f)	
pH	S2 (5.26 – 6.38)
Organic carbon (%)	N(f) (0.17 – 0.09)
Total Nitrogen (%)	N(f) 0.015 – 0.076
Phosphorus (P) (%)	N(f) 0.25 – 5.61
Potassium (K) (%)	N(f) 0.001 – 0.008
SOIL TOXICITY	
Salinity (EC) (ds/m)	S2 (4.7)
Sodicity (ESP) (%)	S3 (15.42)
AGGREGATE SUITABILITY CLASS	
Current	N(s, f)
potential	N(s)
Size (ha)	6.4

4.7 PEDON 2b

CHARACTERIZATION

The physical and chemical properties of pedon 2b are presented in *Table 4.8*. The soil pH ranged from 5.34 to 5.82. The pH was highest (5.82) at the depth of 0 – 17cm while it was lowest (5.34) at the depth 116 – 183cm. The pH values decreased down the profile. The value of Electrical Conductivity (EC) ranged from 29.10μsm^{-1} – 63.20μsm^{-1}. The EC was highest (63.20μsm^{-1}) at the depth of 0 – 17cm while EC was lowest (29.10μsm^{-1}) at the depth of 116 – 183cm. The EC decreased regularly down the profile. The organic carbon ranged from 2.04gkg^{-1} – 19.22gkg^{-1}. The organic carbon was highest (19.22gkg^{-1}) at the depth of 0 – 17cm, while the organic carbon was lowest (2.04gkg^{-1}) at the depth of 116 – 183cm. The organic carbon decreased regularly down the profile. The organic matter ranged from 3.51 – 33.13gkg^{-1}. The organic matter was highest (33.13gkg^{-1}) at the depth of 0 – 17cm while the organic matter was lowest (3.51gkg^{-1}) at the depth of 116 – 183cm, there was a regular decreased down the soil profile. The total Nitrogen ranged from 0.17 – 1.64gkg^{-1}. The Total Nitrogen was highest (1.64gkg^{-1}) at the depth of 0 – 17cm while it was lowest (0.17gkg^{-1}) at the depth 116 – 183cm, the total nitrogen decreased down the profile. The available phosphorus ranged from 1.72 – 6.48$mgkg^{-1}$. The Available phosphorus was highest (6.48$mgkg^{-1}$) at the depth of 0 – 17cm while it was lowest (1.72$mgkg^{-1}$) at a depth of 116 – 183cm. The Available phosphorus decreased down the profile.

The Exchangeable Bases

Ca, Mg, Na, and K, exhibit higher concentrations at depths of 0 – 17cm and lower concentrations at depths of 116 – 183cm. Ca ranges from 0.36 to 1.50$cmolkg^{-1}$, with the highest value (1.60$cmolkg^{-1}$) and lowest (0.50$cmolkg^{-1}$). Mg ranges from 0.19 to 0.50$cmolkg^{-1}$, peaking at 116 – 183cm (0.25$cmolkg^{-1}$) and lowest at 0 – 17cm (0.19$cmolkg^{-1}$). Sodium content ranges from 0.14 to 0.24$cmolkg^{-1}$, with the highest (0.24$cmolkg^{-1}$) at 0 – 17cm and the lowest

($0.14cmolkg^{-1}$) at 116 – 183cm, indicating a regular decrease down the profile. Potassium, ranging from 0.01 to 0.12cmol/kg, decreases down the profile, with the highest value ($0.12cmolkg^{-1}$) at 0 – 17cm and the lowest ($0.01cmolkg^{-1}$) at 116 – 183cm.

Exchange Acidity

The Aluminum values ranges from 0.90 – $0.10cmolkg^{-1}$. The Aluminum value was highest ($0.90cmolkg^{-1}$) at a depth 116 – 183cm while it was lowest ($0.10cmolkg^{-1}$) at a depth of 0 – 17cm. Aluminum was generally lower at the top soil and increased down the profile. The hydrogen ion which was $0.08cmolkg^{-1}$ at the depth of (0 – 17cm) increased down the soil depth. The Hydrogen ion was highest ($0.19cmolkg^{-1}$) at a soil depth of 116 – 183cm and lowest ($0.08cmolkg^{-1}$) at a depth of 0 – 17cm.

The Effective Exchangeable Cation Capacity (ECEC)

ECEC values ranged from $1.79cmolkg^{-1}$ to $2.54cmolkg^{-1}$. The ECEC values decreased with increase in soil depth. ECEC was highest ($2.54cmolkg^{-1}$) at a depth of 0 – 17cm while it was lowest ($1.79cmolkg^{-1}$) at a depth of 116 – 183cm.

The Base Saturation

The Base Saturation (BS) values of the soil ranged from $39.12gkg^{-1}$ to $92.92gkg^{-1}$. The Base saturation was highest ($92.92gkg^{-1}$) at the surface and lowest ($39.12gkg^{-1}$) at the depth of 116 – 183cm. The base saturation decreased down the profile.

Particle Size Distribution

Sand values ranges from $660gkg^{-1}$ to $900gkg^{-1}$; the value was highest ($900gkg^{-1}$) at the surface and decreased down the profile. The silt values ranges from $20gkg^{-1}$ to $30gkg^{-1}$, the slit value was highest ($30gkg^{-1}$) at a depth of 0 – 17cm while it was lowest ($20gkg^{-1}$) at a depth of 116 –

183cm. The silt values decreased down the profile. The percentage clay values ranges from 70 – 320gkg^{-1}. The clay value was highest (320gkg^{-1}) at the depth of 116 – 183cm and lowest (70 gkg^{-1}) at a depth of 0 – 17cm. The clay value increased down the profile.

Textural Class

The textural class ranges from Sand (S), Sandy Loam (SL) to Sandy Clay Loam (SCL)

Table 4.8: PHYSICAL AND CHEMICAL PROPERTIES OF PEDON 2b

izon oth	pH	EC	Org. C	Org. matter	Total N.	Avail P	Ca	Mg	Na	K	H	Al	ECE C	CEC	ECECC LAY	BS	SAND	SIL
cm)	H20	µS/cm	gkg^{-1}		gkg^{-1}	$mgkg^{1}$	→			$cmolkg^{-1}$	←				→	gkg^{-1}	←	
7	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	30.0
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	20.0
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	10.0
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	10.0
-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	20.0
	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	18.0
	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	46.5
	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	8.3
	LV	HV	HV	HV	HV	HV	HV	HV	HV	HV	HV	HV	HV	HV	LV	MV	HV	LV

4.8 SUITABLITY CLASSIFICATION OF PEDON 2b FOR TOMATO CLASSIFICATION

Base on the guidelines in Magaji *et al.* (2020), the following parameter were used in the evaluation of pedon 2a for tomato production.

CLIMATE

Among the climate parameter the most important to crop production is the amounts and distribution of rainfall. From the result obtained, the amount of rainfall in the study area was 1900mm (NIFOR, 2013). This according to Magaji *et al.* (2020) falls in the suitability class S3 (marginally suitable). The mean annual temperature ranges from 30^0C in the study site; this placed the pedon in the suitability class S2 (moderately suitable).

TOPOGRAPHY

The topography of pedon 2b ranges from 2.5 - 9% and falls into class S2 **(**modetately suitable) for tomato cultivation based on the guideline Magaji *et al.* (2020).

WETNESS

The study area of pedon 2b was well drained. This qualified pedon 2b as S1 (highly suitable) according to Magaji *et al.* (2020).

SOIL PHYSICAL CHARACTERISTICS

The soil texture ranged from sand (S), sandy loam (SL) to sandy clay loam (SCL) and this placed pedon 2b in suitability class N (not suitable). The depth of pedon 2b was >75cm which according to the guideline qualifies the pedon to be in suitability class S1 (highly suitable) for tomato cultivation.

FERTILITY CHARACTERISTICS

pH was between 5.34 – 5.82, this rated the pedon as S2 (moderately suitable). The organic carbon ranged from 0.2 – 1.9% this rated the pedon as N. The total Nitrogen ranged from 0.017 – 0.16% which rated the pedon N. The available phosphorus (P) was <10%, hence the pedon was rated N (not suitable). Potassium (K) was <0.15%, and this also rated the pedon as N

SOIL TOXICITY

The salinity (EC) was 3.9dsm^{-1} which rated the pedon S1 while the Sodicity (ESP) was 13.08%, the pedon is rated S1.

AGGREGATE SUITABILITY CLASS

Current: On current suitability ratings, Pedon 2b (5.69ha) representing 47% of the study area was not suitable [N(s, f)] for tomato cultivation because of limitations in soil physical characteristics and fertility characteristics of the pedon.

Potential: Potential suitability rating was not suitable [N(s)] for tomato cultivation due to major limitations in soil physical characteristics in the pedon. The suitability evaluation for pedon 2b is summarized in *Table 4.9*

Table 4.9: Tomato suitability evaluation in pedon 2b

Land Characteristics	Suitability
CLIMATE (c)	
Mean annual Rainfall (mm)	S3 (1900)
Mean annual temp (°C)	S2 (30°C)
TOPOGRAPHY (t)	
Slope (%)	S2 (2.5 – 9)
Wetness (w)	
Drainage	S1 (Well drained)
SOIL PHYSICAL CHARACTERISTIC (s)	
Soil depth (cm)	S1 (>75)
Texture / Structure	N (S – Ls)
FERTILITY (f)	
pH	S2 (5.34 – 5.82)

Organic carbon (%)	N(f) (0.2 – 2.9)
Total Nitrogen (%)	N(f) 0.017 – 0.164
Phosphorus (P) (%)	N(f) 0.17 – 0.65
Potassium (K) (%)	N(f) 0.001 – 0.012
SOIL TOXICITY	
Salinity (EC) (ds/m)	S2 (3.9)
Sodicity (ESP) (%)	S1 (13.08)
AGGREGATE SUITABILITY CLASS	
Current	N(s, f,)
Potential	N(s)
Size (ha)	5.69

4.10: SUMMARY TABLE FOR TOMATO SUITABILITY CLASSIFICATION OF ALL THE PEDONS

Land characteristics	**Pedon 1a**	**Pedon 2a**	**Pedon 1b**	**Pedon 2b**
Climate (C)				
Rainfall (mm)	S3 (1900)	S3 (1900)	S3(1900)	S3 (1900)
Temperature (^{0}C)	S2 (30 ^{0}C)	S2 (30 ^{0}C)	S2 (30 ^{0}C)	S2 (30 ^{0}C)
Wetness (w)				
Drainage	S1 (Well drained)	S1 (Well drained)	S1 (Well drained)	S1 (Well drained)
TOPOGRAPHY (t)				
Slope (%)	S3 (2.59 – 6.09)	S1 (0.79 – 2.6)	S1 (0.2 – 2.1)	S2 (2.5 – 9)
SOIL PHYSICAL CHARACTERISTICS (S)				

Soil depth (cm)	S1 (>75)	S1 (> 75)	S1 (>75)	S1 (>75)
Texture/ Structure (Surface)	N(S – Ls)	N(S – Ls)	N(S – Ls)	N(S – Ls)
Fertility (f)				
pH	S2 (5.02 – 6.22)	S2 (5.66 – 6.14)	S2 (5.26 -6.38)	S2 (5.34 – 5.82)
Organic carbon (%)	N(f) 0.13 – 2.3	N(f) 0.25 – 1.4	N(f) 0.17– 0.09	N(f) 0.2 – 2.9
Total Nitrogen (%)	N(f) (<1)	N(f) (<1)	N(f) (<1)	N(f) (<1)
Phosphorus (%)	N(f) (<10)	N(f) (<10)	N(f) (<10)	N(f) (<10)
Potassium (%)	N(f) (<0.15)	N(f) (<0.15)	N(f) (<0.15)	N(f) (<0.15)
Soil toxicity				
Salinity (EC)	S2 (7.7)	S2 (4.7)	S2 (4.47)	S2 (3.9)
Sodicity (ESP)	S2 (16.9)	S2 (18.18)	S3 (15.42)	S1 (13.08)
Aggregate Suitability Class				
Current	N (s, f)	N (s, f)	N (s, f)	N (s, f)
Potential	N (s)	N (s)	N (s)	N (s)
Size (ha)	1.65	2.64	6.4	5.69
Percentage	38%	62%	53%	47%

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATION

Tomato (*Solanum lycopersicum)* is one of the most important vegetable crops in Nigeria, both in terms of consumption and economic value. However, challenges such as land degradation, climate variability, and inadequate infrastructure pose constraints to sustainable tomato cultivation, highlighting the critical link between tomato farming and land suitability. Land suitability refers to the degree to which a particular area of land is suitable for a specific land use or activity, taking into account its inherent properties and the requirements of the proposed land use. Land evaluation involves systematically assessing the suitability of land for various activities or purposes. And this can be achieved through various methods such as limitation method, parametric method, quantitative and qualitative methods.

The aim of this study was to determine the level of suitability of a 4 hectare land (site A) and a 12 hectare parcel of land (site B) in Iguzama Community in Ovia North East Local Government area of Edo state, Nigeria for Tomato cultivation. Four mapping units, 1a, 2a, 1b and 2b were delineated using the rigid grid system soil survey process. Each of the mapping unit was represented by a pedon which was appropriately described according to the FAO (1976) method.

The current aggregate suitability evaluation of the land revealed that pedon 1a (1.65ha), pedon 2a (2.64ha), pedon 1b (6.4ha) and pedon 2b (5.69ha) representing 38%, 62%, 53% and 47% of the study area respectively were not suitable (N) for tomato cultivation due to severe limitations in soil physical characteristics and fertility. Key limitations included sandy texture (top soil), deficiency in Nitrogen, Phosphorus and Potassium. The potential rating showed that there was no difference in aggregate suitability classes of the pedons which buttresses the fact that the major limitation encountered in the study area cannot be altered.

From the above result, I therefore recommend that the area represented by pedon 1a, 2a, 1b and 2b which were not suitable according to the crop requirements for tomato should not be used for tomato cultivation. However, the mapping units may be used for other purposes that the study area can support.

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