

GUIDELINES

FOR LAND SUITABILITY EVALUATION

*Development of Agriculture, Livestock,
Fisheries, & Forestry Commodities*



TIMOR-LESTE

GUIDELINES FOR LAND SUITABILITY EVALUATION FOR THE DEVELOPMENT OF AGRICULTURAL, LIVESTOCK, FISHERIES, AND FORESTRY COMMODITIES IN TIMOR-LESTE



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Land Evaluation Guidelines

INTRODUCTION



GUIDELINE FOR LAND SUITABILITY EVALUATION

DEVELOPMENT OF AGRICULTURAL, LIVESTOCK, FISHERIES, AND FORESTRY COMMODITIES IN TIMOR-LESTE

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FOREWORD

With the grace of Almighty God, this Guideline for Land Suitability Evaluation: Development of Agricultural, Livestock, Fisheries, and Forestry Commodities in Timor-Leste has been prepared as a reference for understanding and applying the concept of evaluating land resource potential in land-use planning. Increasing development activities and global population growth have created significant pressure on land demand, both for agriculture and other sectors. The need for productive land continues to rise, while fertile land is diminishing due to land conversion and environmental degradation. Therefore, land evaluation serves as a strategic step to optimize sustainable land use in support of food security and climate change mitigation.

As a developing country, Timor-Leste faces major challenges in building an independent and sustainable agricultural system. With dryland ecosystems dominating most of its territory, the country must optimize land use to support national food security and economic development. This guideline is presented as a reference that can be used by stakeholders, including government, academia, and agricultural practitioners, in evaluating land suitability for various agricultural commodities, including food crops, horticulture, plantation and industrial crops, spices and medicinal plants, forestry species, and forage crops.

This guideline consists of two main sections. The first section discusses Land Suitability Evaluation, focusing on the development of various agricultural commodities based on land characteristics in Timor-Leste. This section explains the importance of land-use planning, theoretical foundations of land evaluation, concepts and definitions, objectives and benefits of land evaluation, as well as approaches and procedures for conducting land evaluation. Guidance for observing land qualities and characteristics in the field is also provided to ensure that evaluation results are accurate and applicable.

The approach used in this guideline adapts land evaluation systems developed in Indonesia, including crop growth requirement criteria based on the studies of Ritung et al. (2011). In addition, this book applies approaches based on field observations, laboratory analyses, and spatial analysis using Geographic Information Systems (GIS), enabling more precise and

scientifically based land suitability mapping. This approach is highly relevant for supporting sustainable, efficient, and environmentally adaptive agricultural development planning in Timor-Leste.

We acknowledge that this book still has limitations, given the complexity of land evaluation, which continues to evolve along with advancements in science and technology. Therefore, we welcome constructive feedback and suggestions for improvement in future editions. We also express our appreciation to all parties who contributed to the preparation of this guideline through research, discussions, and data provision.

Finally, we hope that this book will provide broad benefits for stakeholders in supporting more optimal land management and strengthening food self-sufficiency in Timor-Leste.

Dili-Timor-Leste, January 2025

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I. INTRODUCTION

Land is one of the natural resources that plays a strategic role in supporting the sustainability of human life. The availability of land that is suitable for various activities, particularly agriculture, is a determining factor in maintaining food security, reducing the risk of environmental degradation, and supporting economic and social development. As the demand for food and infrastructure development increases, competition for land use between the agricultural and non-agricultural sectors becomes more intense. This condition requires a systematic and science-based approach to determine land suitability in order to ensure optimal, efficient, and sustainable utilization.

In the global context, land evaluation is part of efforts to achieve the Sustainable Development Goals (SDGs), particularly SDG 2 (Zero Hunger), SDG 13 (Climate Action), and SDG 15 (Life on Land). Accurate land evaluation based on scientific data contributes to responsible natural resource management, mitigation of climate change impacts, and protection of biodiversity. The increasingly evident manifestations of climate change, such as rising global temperatures, shifts in rainfall patterns, and the increasing frequency of extreme events such as droughts and floods, further reinforce the urgency of conducting land evaluations that are adaptive and mitigation oriented.

As a country that only gained independence in 2002, Timor-Leste faces major challenges in the management of its land resources. Land structure dominated by hilly topography and steep slopes increases the risk of erosion and soil degradation, which directly affects agricultural productivity and the quality of coastal aquatic environments. The agricultural sector is the backbone of the national economy, while the fisheries sector, particularly pond aquaculture, has substantial potential to support food security and economic diversification. However, both sectors still face constraints in the form of limited technology, inadequate infrastructure, and suboptimal management practices. Therefore, an integrated guideline is needed to direct sustainable land management for both sectors.

Land evaluation aims to identify and classify the degree of land suitability based on relevant biophysical, social, and economic characteristics. In the agricultural context, the main biophysical factors include soil properties, topography, climate, hydrology, and water availability, while in the fisheries context, the evaluation focuses on water conditions, salinity, tidal regime,

coastal soil texture, and pond water quality. The socio-economic factors include regional accessibility, supporting infrastructure, and community technological capacity. This evaluation enables the formulation of appropriate land management strategies, prevents inappropriate land uses, and increases the efficiency of natural resource utilization.

The framework used in this guideline refers to the Framework for Land Evaluation (FAO, 1976), which has become the international standard for land suitability analysis. In the agricultural sector, the land suitability classification system applied adapts the guidelines “Kriteria Kesesuaian Lahan untuk Tanaman Pertanian dan Tanaman Kehutanan” (Djaenudin *et al.*, 1994) and “Evaluasi Lahan untuk Komoditas Pertanian” (Djaenudin *et al.*, 2003). For the fisheries sector, the main reference used is the Land Suitability for Brackish Water Fishponds model developed by Hardjowigeno *et al.*, 1996. These two systems are combined in a single integrated approach that simultaneously considers terrestrial and coastal aspects, so that they can be used to delineate zones for agricultural development and aquaculture in a synergistic manner.

With advances in digital technology, land evaluation approaches are increasingly supported by methods based on Geographic Information System (GIS), Remote Sensing, and Artificial Intelligence (AI). The use of spatial models such as Random Forest, Support Vector Machine (SVM), and Decision Tree allows the integration of various environmental variables, both terrestrial and coastal, to produce more precise land suitability analyses. This approach is highly relevant in Timor-Leste, given the limited human resources and facilities available for conducting large-scale conventional surveys.

The success of land evaluation implementation strongly depends on data quality and the appropriateness of mapping scale. Comprehensive field surveys are required to obtain accurate data on soils, climate, and other biophysical conditions. The selection of an appropriate mapping scale ensures that the evaluation results can be effectively applied in land use planning and management, both for agricultural activities on land and pond aquaculture along the coast.

This guideline is prepared as a technical reference for various stakeholders, including government, academics, spatial planners, and practitioners in agriculture and fisheries, in designing land use strategies that are effective and sustainable. The integrated approach is expected to support cross-sectoral regional development planning, increase agricultural and

fisheries productivity, and maintain a balance between economic utilization and environmental conservation.

With this integrated guideline, land evaluation in Timor-Leste is expected to be implemented in a systematic manner, based on scientific data, and with comprehensive consideration of environmental, social, and economic aspects. Comprehensive land evaluation will become an important foundation for the development of agricultural and fisheries sectors that are adaptive to climate change, oriented toward food security, and grounded in ecosystem sustainability principles. In this way, land use in Timor-Leste can proceed synergistically between terrestrial and coastal zones, creating a balance between human needs, economic productivity, and environmental conservation.

II. LAND EVALUATION

Land evaluation is an estimation process to assess the degree of land suitability for various alternative uses, taking into account the relevant policy and regulatory frameworks. In Timor-Leste, land evaluation plays an important role in supporting food security policies, land use planning, and sustainable development strategies. National regulations governing the utilization of land resources serve as a basis for determining land use priorities for the agriculture, forestry, and conservation sectors. In addition, land evaluation can provide the foundation for formulating policies on soil degradation mitigation, protection of critical ecosystems, and climate change adaptation through more efficient and science-based land use planning for agriculture, forestry, tourism, land conservation, and other uses. This evaluation aims to ensure that land utilization is carried out optimally by considering biophysical factors, socio-economic conditions, and environmental sustainability aspects in order to support sustainable land use planning.

Land evaluation methods can be implemented manually or using computer-based approaches. Computer-based approaches have developed rapidly with the application of technologies such as Geographic Information System (GIS), Decision Support System (DSS), and Artificial Intelligence (AI) based models. DSS is used to support decision-making by integrating spatial and non-spatial data to determine land suitability for various purposes. Meanwhile, AI-based methods, such as machine learning, enable large-scale analysis of land data with higher accuracy, for example through the use of Random Forest or Support Vector Machine models in predicting land suitability based on environmental and agronomic factors. Thus, these approaches increase the efficiency of land evaluation and support more accurate and predictive data-based planning. Computer-based approaches, such as the use of GIS and spatial analysis based on geostatistical or machine learning models, allow large amounts of data to be processed efficiently. The accuracy of the assessment strongly depends on the quality of the available data and the validity of the assumptions used in the analysis process.

2.1 Basic Concept

In land evaluation, several key terms need to be understood, particularly those related to land resources and specific land use requirements. The main terms in land evaluation include the concepts of land, land use, land characteristics, land qualities, and land use requirements.

A. Land

Land is part of the landscape that encompasses physical environmental components such as climate, topography/relief, soil, hydrology, and natural vegetation that have the potential to influence land use patterns (FAO, 1976). In a broader sense, land also includes areas that have been modified by biological and anthropogenic activities and natural processes, such as tidal land reclamation or the implementation of soil conservation techniques within an ecosystem.

Optimal land use must take into account land characteristics and land qualities to ensure ecosystem sustainability. This is due to the presence of natural limitations that restrict certain types of use and that, if ignored, can result in long-term land degradation. In land resource mapping analysis, land is classified into mapping units that can be distinguished based on key parameters such as climate, geomorphology (including lithology and topography/relief), soil, and hydrology. The delineation of land units is essential for interpreting land suitability potential for various Land Utilization Types (LUTs).

Land evaluation is conducted by analyzing physical environmental characteristics that are grouped into land qualities. Each land quality may consist of one or more interrelated land characteristics that influence land suitability for a given use (FAO, 1983). For example, land qualities that affect crop growth include water availability, nutrient availability, effective soil depth, and erosion severity.

B. Land Use

Land use refers to the utilization of a land area for specific purposes. In the agricultural sector, land use is generally differentiated into:

1. **Seasonal Land Use:** intended for crops with a life cycle of less than one year. Examples include food crops such as rice, maize, and soybean.
2. **Perennial land use:** applied to crops with a long production cycle, such as coffee, cacao, or rubber plantations.
3. **Permanent land use:** land that is not allocated for agriculture but for ecological or infrastructural functions, such as protected forest, conservation areas, settlements, and industrial zones.

In this guideline, the land use requirements are presented for 121 types of agricultural commodities categorized according to agroecological suitability in Timor-Leste. This classification process takes into account biophysical factors such as soil type, water availability, microclimate, and slope gradient, which strongly influence the productivity of specific commodities. In addition to biophysical aspects, the classification also considers socio-economic factors such as land accessibility to markets, supporting infrastructure, and the availability of labor and agricultural technology. With this approach, land evaluation functions not only to determine the theoretical suitability of agricultural commodities but also to support more sustainable and data-based land use planning in Timor-Leste. The commodities are grouped into several categories, namely food crops, horticultural crops, plantation crops, spice and medicinal crops, forestry species, forage crops and grazing land, as well as brackish water fisheries.

In more detail, land use types can be classified based on 11 main attributes that reflect management systems and production models (FAO, 1976), as presented in Table 2.1. According to FAO (1976), land use in evaluation can be categorized more specifically as Land Utilization Types (LUTs), which take into account management aspects, required inputs, and expected outputs. Based on the management pattern, land use types are distinguished into two groups:

1. Multiple Land Utilization

Multiple Land Utilization is a land use system that allows more than one commodity to be cultivated simultaneously at a single location. Each commodity is managed with its own inputs and outputs. An example is the planting of coconut in intercropping systems with cacao or coffee.

2. Compound Land Utilization

Compound Land Utilization refers to land use for several commodities at a single location that is treated as one management unit. Differences in use may occur in a temporal sequence or spatially in different blocks managed by a single organization. An example is a large estate that manages several land blocks for rubber and oil palm under one management system.

By understanding the various basic concepts in land evaluation, its application in Timor-Leste can have tangible implications for agricultural policy and environmental sustainability. Systematic land evaluation can assist the government in establishing agricultural zonation based on land suitability, reducing the risk of soil degradation resulting from inappropriate cultivation practices, and supporting ecosystem conservation efforts. In addition, the use of land evaluation results in land use planning can increase the efficiency of agricultural production, optimize the use of natural resources, and support adaptation to climate change by identifying areas that are vulnerable to erosion, drought, or soil degradation. This method can be applied effectively in Timor-Leste to support land resource management that is more adaptive, productive, and sustainable in accordance with local agroecological characteristics.

Table 2.1 Eleven land use type attributes

No	LUT Attribute	Description
1.	Result	Profit from farming
2.	Market Orientation	Production objective (commercial, subsistence, or household scale)
3.	Capital intensity	Amount of capital used
4.	Labor intensity	Number of workers
5.	Land preparation	Carried out by humans, machinery, or animals
6.	Technical knowledge and farmer culture	Level of farmers' knowledge
7.	Land management technology	Use of varieties, fertilization, pest and disease control, management of organic matter, manure, etc.
8.	Infrastructure requirements	Requirements for production infrastructure
9.	Farm land area	Size of the farm land
10.	Land tenure status	Status of farm land (individually or collectively owned, rented)
11.	Income level	Income calculation (per capita, per farmer, or per unit area)

Source: FAO (1976).

C. Land Characteristics

Land characteristics are land properties that can be measured or estimated. In this integrated guideline, the land characteristics analyzed include topography, soil conditions, water quality, and climate, all of which are used as the basis for land suitability evaluation for the development of agricultural and fisheries commodities.

Each land/soil mapping unit resulting from land resource survey and mapping activities has characteristics that can be specified and described as land characteristics, including both soil characteristics and the physical characteristics of the environment. These data are used for the interpretation and evaluation of land for specific commodities, as well as for other purposes such as assessing erosion hazard levels and other relevant biophysical hazards. In the agricultural context, the land characteristics analyzed include mean annual temperature, rainfall (annual or during the growing season), air humidity, drainage, texture, coarse fragments, effective depth, peat maturity and thickness, cation exchange capacity (CEC), base saturation (BS), pH, organic C, total N, P₂O₅, K₂O, salinity, alkalinity, sulfidic depth, slope, surface rock, rock outcrops, landslide hazard, erosion hazard, and flood hazard (flood

height and duration of inundation). In the aquaculture context, particularly for ponds, the characteristics considered also include slope gradient and soil conditions (clay percentage, soil pH, organic carbon), as well as water quality, which includes temperature, salinity, pH, total dissolved solids, ammonia, and dissolved oxygen. Climate is assessed through annual rainfall and dry months, which influence water availability for both crops and pond aquaculture systems. A description of each land characteristic is presented in **Table 2.2**

Table 2.2 Land characteristics used in land evaluation for agricultural commodities.

No.	Land Characteristics	Description
1	Average annual temperature	: Mean annual air temperature (°C)
2	Rainfall	: Total annual rainfall or rainfall during the growing season (mm)
3	Air Humidity	: Degree of air moisture or amount of water vapor in the air (%)
4	Drainage	: Effect of the rate of water percolation into the soil on soil air aeration
5	Texture	: Proportion of sand (0.05 to 2.0 mm), silt (0.002 to 0.05 mm), and clay (< 0.002 mm)
6	Coarse Fragment	: Material with particle size > 2 mm (%).
7	Effective Soil Depth	: Depth of the soil layer that can be utilized for crop root development (cm).
8	Peat Maturity	: Degree of fiber content, where higher fiber content indicates lower peat maturity. Peat maturity is classified as sapric (well decomposed), hemic (moderately decomposed), and fibric (slightly decomposed).
9	Peat Thickness	: Thickness of the peat layer (cm).
10	Soil Cation Exchange Capacity	: Soil capacity to exchange cations (CEC) (cmolc kg ⁻¹ soil).
11	Base Saturation (BS)	: Amount of bases extracted by NH ₄ OAc in each 100 g soil
12	Soil pH	: [H ⁺] concentration in the soil solution; the higher the [H ⁺], the more acidic the pH, and conversely, the lower the [H ⁺], the more basic the pH.
13	Soil Organic Carbon	: Soil organic carbon (SOC) content in the soil (%)
14	Total Nitrogen	: Total nitrogen content in the soil (%)
15	P ₂ O ₅	: P ₂ O ₅ content extracted with 25 % HCl in the soil (mg 100 g ⁻¹ soil).
16	K ₂ O	: K ₂ O content extracted with 25 % HCl in the soil (mg 100 g ⁻¹ soil).

17	Salinity	:	Amount of readily soluble salts in the soil, indicated by electrical conductivity (dS m^{-1}).
18	Alkalinity	:	Amount of exchangeable sodium (Na) (%) in the soil.
19	Sulfidic Depth	:	Depth of sulfidic material measured from the soil surface to the upper boundary of the sulfidic layer (cm)
20	Slope	:	Slope gradient of the land (%)
21	Surface Rock	:	Volume of rock fragments found on the soil surface (%)
22	Rock Outcrops	:	Volume of rock that appears at the soil surface (%)
23	Landslide Hazard	:	Mass movement of rock or soil
24	Erosion Hazard	:	Amount of soil lost from a land unit, predicted using the USLE equation ($\text{t ha}^{-1} \text{ year}^{-1}$).
25	Flood Hazard	:	Indicates floodwater height and duration of inundation (cm month^{-1}).

Source: Ritung *et al.*, (2011)

Land characteristics used in the evaluation may be single or multiple in nature because they interact with one another. Therefore, interpretation needs to consider or compare the land with its use in terms of land qualities. For example, the land quality of water availability is determined by the number of dry months and annual rainfall, but the water available to crops also depends on other land qualities such as rooting medium (texture and effective soil depth), while for pond aquaculture, water availability and quality are strongly influenced by a combination of coastal soil properties and water quality parameters. The interaction among these characteristics determines the level of land suitability for various uses, so the evaluation must be carried out in an integrated manner by taking into account the specific requirements of agricultural and fisheries commodities.

Thus, a comprehensive understanding of land characteristics and their interactions becomes the main foundation for interpreting and evaluating land suitability. This approach enables the identification of more appropriate land use directions, both for agricultural and fisheries production systems, thereby supporting land use planning that is efficient, sustainable, and adaptive to local biophysical conditions.

D. Land Qualities

Land qualities are complex diagnostic properties or attributes of a land unit. Each land quality consists of one or more land characteristics that can be measured or estimated, either directly in the field or through more detailed analysis of land characteristics. In general, the determination of land qualities is based on the interpretation of various land characteristics (FAO, 1976).

In land evaluation, land qualities are often not used directly but are substituted by land characteristics, because both are considered to have equivalent value (Driessen, 1971; Staf PPT, 1983). Land qualities may have positive or negative impacts on land use, depending on their nature. A positive impact occurs when a land quality supports a particular use, whereas a negative impact arises when the land property becomes a limiting or constraining factor. Each land quality may influence one or more types of land use, while a single type of land use is also influenced by multiple land qualities.

In this guideline, the land qualities used for land evaluation are presented in **Table 2.3**.

Table 2.3 Land qualities used in land evaluation for agricultural commodities

No	Land Qualities	Descriptions
1	Temperature (tc) :	Determined by mean annual temperature.
2	Water availability (wa) :	Determined by rainfall (annual and during the growing season), air humidity, and agroclimate zone.
3	Oxygen availability (oa) :	Determined by drainage.
4	Rooting Condition (rc) :	Determined by drainage, texture, coarse fragments, effective soil depth, and peat maturity and thickness.
5	Nutrient retention (nr) :	Determined by soil cation exchange capacity (CEC), base saturation (KB), soil pH, and soil organic carbon (SOC).
6	Available nutrients (na)	Determined by Total Nitrogen, P ₂ O ₅ dan K ₂ O
7	Toxicity (xc) :	Determined by salinity
8	Sodicity (xn) :	Determined by alkalinity
9	Sulfidic hazard (xs) :	Determined by sulfidic depth.
10	Erosion hazard (eh) :	Determined by erosion hazard and soil depth.
11	Flooding or inundation hazard (fh) :	Determined by floodwater height and duration of inundation.
12	Land preparation (lp) :	Determined by surface rock and rock outcrops.

Source: Ritung *et al.*, (2011)

E. Land Use Requirements

All agricultural commodities have land use requirements that must be met for them to grow and produce optimally. To facilitate the implementation of land evaluation, land use requirements need to be linked to land qualities and land characteristics. The land use requirements for each agricultural commodity generally differ, although some may be similar.

The land use requirements needed by each agricultural commodity have minimum, optimum, and maximum threshold ranges for every land characteristic. These ranges are presented in Appendices 1 to 6. Land qualities that are optimum for crop growth or land use define the limits for the highly suitable (S1) land suitability class. Land qualities below the optimum define the limits for the moderately suitable (S2) and/or marginally suitable (S3) classes. Outside these limits, the land is physically classified as not suitable (N).

2.2 Land Suitability Classification

Land suitability refers to the degree of fitness of a land unit for a given use. Land suitability can be assessed under current conditions or after improvement measures have been applied. More specifically, land suitability is determined by the degree of match between physical environmental factors, such as climate, soil, topography, hydrology, and drainage, and the requirements of a given productive farming system or specific commodity.

Land suitability differs from land capability. Land capability refers to the capacity of land for various uses in general. The more types of use that can be developed, the higher the land capability. In contrast, land suitability focuses more on the fitness of land for specific uses, taking management aspects into account.

A. Structure of Land Suitability Classification

The structure of the land suitability classification used in this guideline is essentially based on the Framework for Land Evaluation (FAO, 1976), which applies four categories: order, class, subclass, and unit. In semi-detailed level soil mapping, land suitability classification is carried out up to the subclass level.

Order	: Describes land suitability in general. At the order level, land suitability is differentiated into land classified as suitable (S) and land classified as not suitable (N).
Class	: Describes the degree of land suitability within an order. At the class level, land belonging to the suitable order (S) is subdivided into highly suitable land (S1), moderately suitable land (S2), and marginally suitable land (S3). Land under the not suitable order (N) is not further subdivided.
Highly Suitable Class (S1)	: Land that has no significant or serious limiting factors for sustainable use, or only has minor limitations that do not significantly reduce land productivity.
Moderately Suitable Class (S2)	: Land that has limiting factors that affect its productivity and require additional inputs. These limitations can generally still be addressed by farmers.
Marginally suitable class (S3)	: Land that has severe limiting factors that affect its productivity and requires higher additional inputs than land in class S2. Overcoming the limiting factors in S3 requires substantial capital, so support or intervention from the government or the private sector is needed because farmers are not able to address them on their own.
Not Suitable Class (N)	: Land that is not suitable (N) because it has very severe

limiting factors and/or limitations that are difficult to overcome.

Subclass : Describes the degree of land suitability within a class. Land suitability classes can be differentiated into subclasses based on the land qualities and characteristics that constitute the most severe limiting factors. Ideally, the maximum number of limiting factors is two. Depending on the influence of the limiting factors in a subclass, the resulting land suitability class can be improved in accordance with the inputs required.

Unit : Describes the degree of land suitability within a subclass, based on additional properties that affect land management. All units within the same subclass have the same level in the class and share the same type of limiting factor at the subclass level. One unit differs from another in additional properties or management aspects required, and these differences further specify the nature of the limiting factors. Knowing the limitations at the unit level facilitates detailed interpretation in farm planning. For example, classes S3r1 and S3r2 have the same class and subclass, with the same limiting factor, namely effective soil depth, but the units differ. Unit 1 has moderate effective depth (50 to 75 cm), while Unit 2 has shallow effective depth (< 50 cm). In practical land evaluation, land suitability at the unit category is rarely used.

B. Types of Land Suitability

According to FAO (1976), there are two types of land suitability, namely qualitative land suitability and quantitative land suitability. Each type of land suitability can be assessed either under current conditions or after improvement, referred to as actual land suitability and potential land suitability. Qualitative land suitability is land suitability assessed solely on the basis of the physical condition of the land, without explicitly taking into account production, inputs, and profits that may be obtained. Quantitative land suitability is land suitability that is not only based on the physical condition of

the land, but also considers economic aspects such as input output or cost benefit.

Actual land suitability is the land suitability obtained from an evaluation based on the present condition of the land (actual land suitability), without improvement inputs. In contrast, potential land suitability is the land suitability obtained under land conditions that have received improvement inputs, such as fertilization, irrigation, or terracing, depending on the type of limiting factor.

III. LAND EVALUATION PROCEDURE

Land evaluation is generally a follow-up activity to soil survey and mapping or other land resource mapping conducted through the interpretation of soil data and physical environmental conditions for specific land use purposes. In line with the level of soil mapping, land evaluation can also be differentiated based on the availability of data produced at a given mapping scale.

3.1 Approach

In land evaluation, there are two types of approaches from the initial consultation stage to land suitability classification. These approaches are: 1) the two stages approach, and 2) the parallel approach (FAO, 1976).

1. Two Stage Approach

Two stages approach consists of a first stage of physical land evaluation and a second stage of economic land evaluation. This approach is usually used in land resource inventories, both for macro planning purposes and for studies testing production potential (FAO, 1976).

Physical land evaluation (first stage) is carried out for the types of land use that have been selected at the beginning of the survey activities, such as for dryland fields (arable land), paddy fields, or plantations. The results of this activity are presented in the form of reports and maps, which then become the subject of the second stage (economic land evaluation) to be followed up immediately with an analysis of economic and social aspects.

2. Parallel Approach

In the parallel approach, land evaluation activities for physical and economic aspects are conducted simultaneously, in other words, the economic and social analysis of the land use types is carried out in parallel with the assessment of physical factors. This approach is generally advantageous as a specific reference in relation to land development projects at semi-detailed and detailed levels. Through the parallel approach, it is expected that more definitive results can be obtained within a shorter period of time.

3.2 Data Preparation

To conduct land evaluation, whether using the two stages approach or the parallel approach, an initial consultation is required. This initial consultation is useful for determining the objectives of the land evaluation to be carried out, the data required, and the assumptions used as the basis for the assessment. The land evaluation to be conducted depends on the objectives, which must be supported by the availability of land resource data and information. The flowchart of activities in land evaluation is presented in **Figure 3.1**.

Implementation of land evaluation is distinguished into three levels, namely reconnaissance level (scale 1:250,000), semi-detailed level (scale 1:25,000 to 1:50,000), and detailed level (scale 1:10,000 to 1:25,000). The type, amount, and quality of data produced at these three mapping levels differ, so the presentation of land evaluation results also differs. At the reconnaissance level, the evaluation results are presented up to the order level; at the semi-detailed level, up to the class/subclass level; and at the detailed level, up to the subclass/subunit level. This Technical Guideline is prepared for land evaluation at the semi-detailed mapping level.

In principle, land suitability evaluation for agricultural development and aquaculture is carried out by matching land characteristics with land use requirements or crop growth requirements, management and conservation requirements, as well as land characteristic requirements for aquaculture. In the context of aquaculture, the assessment is conducted by matching land characteristics such as topography, soil conditions, water quality, and climate with the respective land characteristic requirements for aquaculture. In the matching process, Liebig's law of the minimum is used to determine the limiting factor that will influence the land suitability class and subclass. Liebig's law states that plant growth is not limited by the total amount of nutrients available, but by the nutrient present in the lowest amount; by the same principle, the most limiting environmental factor becomes the main determinant of land suitability level for both agricultural and fisheries systems.

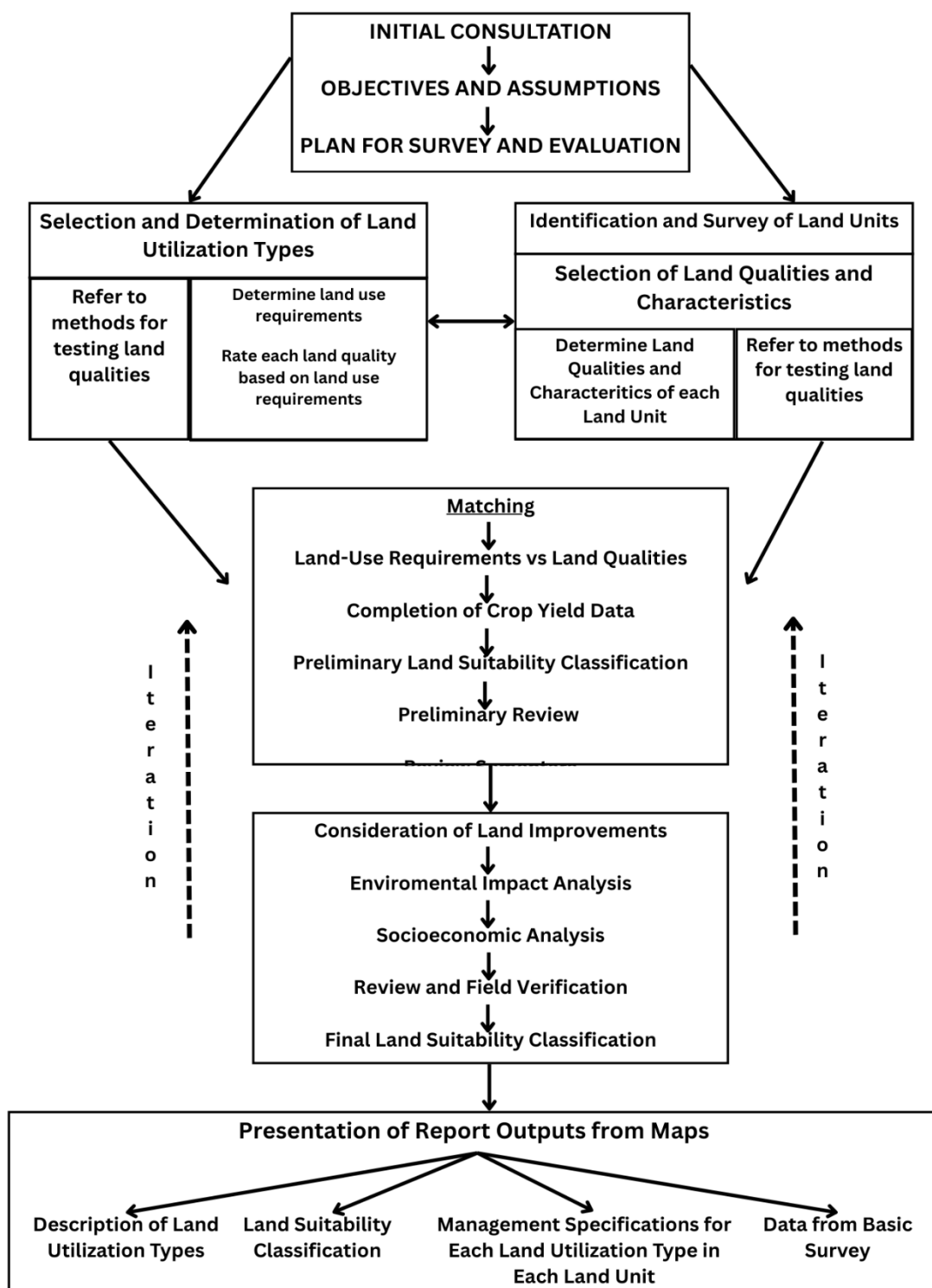


Figure 3.1 Flowchart of activities in land evaluation (FAO, 1983)

3.3 Assumptions Used in Land Evaluation

In land evaluation, it is necessary to establish assumptions that describe the scope, conditions, and management level to be applied, as well as the orientation of the evaluation (Djaenudin *et al.*, 1994). Several aspects that need to be specified as assumptions in semi-detailed land evaluation include:

1. Land evaluation procedure: physical quantitative or other approaches.
2. Data: site data or mean values for SPT (Soil Mapping Unit).
3. Population and socio-cultural aspects: not considered.
4. Infrastructure and accessibility: not considered.
5. Land tenure: not considered.
6. Land management level: differentiated into low, medium, and high. The criteria for each level and the improvement measures that can be implemented to achieve potential land suitability are described.
7. Economic aspects: considered only in general terms; included under economic aspects are marketing factors, input output values, and net profit.
8. With appropriate technology, land that naturally has a low land suitability class (actual land suitability) can be improved to a higher suitability class (potential land suitability). However, not all land qualities or characteristics can be improved with current technology, or a high management level is required to improve them. **Table 2.4** presents the types of improvement measures and the management levels required to improve several land qualities/characteristics. The assumed degree of improvement (management) that can be applied for several land qualities/characteristics is shown in **Table 3.1**.

Table 3.1 Types of improvement measures for actual land qualities/characteristics to become potential according to management level in the agriculture, livestock, and forestry sectors

No.	Land Quality / Characteristic	Type Of Improvement Measure	Management Level
1.	Temperature (tc) - Average Annual Temperature	Cannot be improved	-
2.	Water Availability (wa) - Annual Rainfall - Rainfall during the growing season	Irrigation Irrigation	Medium, High Medium, High
3.	Rooting Condition (rc) - Drainage - Texture - Coarse Fragment - Effective Soil Depth - Peat: a) Maturity b) Thickness	Improvement of the drainage system, such as construction of drainage channels Cannot be improved Cannot be improved Generally not feasible, except for soft and thin hardpan layers that can be broken up during land preparation Adjustment of the drainage system to accelerate peat maturation Use of peat compaction techniques, planting techniques, and variety selection.	Medium, High - - High High High
4.	Nutrient Retention (nr) - CEC - BS - pH - Soil Organic Carbon (SOC)	Liming or addition of organic matter	Medium, High
5.	Availability Nutrients (na) - Total Nitrogen - Available Pottasium - Available Phosphorus	Fertilization	Low, Medium, High
6.	Toxicity (xc) - Salinity	Reclamation	Medium, High
7.	Sodicity (xn) - Alkalinity	Reclamation	Medium, High
8.	Sulfidic Material (xs) - Sulfidic depth	Regulation of the groundwater system so that the water table is maintained above the sulfidic layer	Medium, High

9.	Erosion Hazard (eh)	Measures to reduce the erosion rate, such as construction of terraces or ridges, contour planting, strip cropping, planting cover crops, and mulching	Medium, High
10.	Flood Hazard (fh) - Height - Duration	Construction of flood control embankments and drainage channels to accelerate water removal	High
11.	Land Preparation (lp) - Surface Rock - Rock Outcrops	Cannot be improved	-

Description:

- **Low management level:** Management can be carried out by farmers with relatively low costs.
- **Medium management level:** Management can be carried out by intermediate-level farmers and requires medium capital and intermediate farming techniques.
- **High management level:** Management can only be carried out with relatively large capital and is generally implemented by the government or large or medium-scale companies.

Table 3.2 Assumptions improvement of actual land qualities become potential according to management level in agriculture, livestock, and forestry sectors

No.	Land quality / characteristic	Management Level		
		Low	Medium	High
1	Temperature (tc) - Average annual temperature	-	-	-
2	Water Availability (wa) - Dry Month - Annual Rainfall - rainfall during the growing season	- - -	+ + +	++ ++ ++
3	Rooting Condition (rc) - Drainage - Texture - Corse Fragment - Soil Effective Depth - Peat a) Maturity b) Thickness	- - - - - - -	+ - - - - - -	++ - - + + + +
4	Nutrient Retention (nr) - CEC - BS - pH - SOC	- - - -	+ + + +	++ ++ ++ ++
5	Available Nutrient (na) - Total Nitrogen - Available Pottasium - Available Phosphorus	+ + +	++ ++ ++	+++ +++ +++
6	Toxicity (xc) - Salinity	-	+	++
7	Sodicity (xn) - Alkalinity	-	+	++
8	Sulfidic Hazard (xs) - Sulfidic/Pyrite depth	-	+	++
9	Erosion Hazard (eh)	-	+	++
10	Flood Hazard (fh) - Height - Duration	- -	+ +	++ ++
11	Land Preparation (lp) - Surface Rock - Rock Outcrop	- -	- -	+ +

Descriptions:

- Improvement cannot be carried out.
- + Improvement can be carried out and will result in an increase of one class level (S3 to S2).
- ++ Increase of two class levels (S3 to S1).
- +++ Increase of three class levels (N1 to S1).

Table 3.3 Types of improvement measures for actual land qualities/characteristics to become potential according to management level in the fisheries sector

No.	Land Quality/Characteristic	Type of Improvement Measure	Management Level
1	Topography - Slope Gradient (%)	Cannot be improved	–
2	Soil Conditions - Clay percentage - pH _F –pH _{FOX} - Organic Carbon	Use of tarpaulin, liming, or monitoring of organic matter	Medium, High
3	Water Quality - Temperature (°C) - Salinity (ppt) - pH - TDS (<i>Total Dissolved Solid</i>) - Ammonia (mg/L) - DO (mg/L)	Addition of freshwater/seawater, water filtration, use of probiotics, addition of aeration	Low, Medium, High
4	Climate - Annual rainfall - Dry Month	Cannot be improved	–

Descriptions:

- **Low management level:** Management can be carried out by farmers or aquaculture operators with relatively low costs.
- **Medium management level:** Management can be carried out by intermediate-level aquaculture operators and requires medium capital and intermediate aquaculture techniques.
- **High management level:** Management can only be carried out with relatively large capital and is generally implemented by the government or large or medium-scale companies.

Table 3.4 Assumptions on the degree of improvement of actual land qualities to become potential according to management level in the fisheries sector.

No.	Land Quality/Characteristic	Management Level		
		Low	Medium	High
1	Topography - Slope Gradient (%)	-	-	+
2	Soil Conditions - Clay percentage - pH _F -pH _{FOX} - Organic Carbon	- - -	+ + +	++ ++ ++
3	Water Quality - Temperature (°C) - Salinity (ppt) - pH - TDS (<i>Total Dissolved Solid</i>) - Ammonia (mg/L) - DO (mg/L)	+ + + + + +	++ ++ ++ ++ ++ ++	+++ +++ +++ +++ +++ +++
4	Climate - Annual rainfall - Dry Month	- -	- -	- -

Descriptions:

- Improvement cannot be carried out.

+ Improvement can be carried out and will result in an increase of one class level (S3 to S2).

++ Increase of two class levels (S3 to S1).

+++ Increase of three class levels (N1 to S1).

IV. MEASUREMENT OF LAND SUITABILITY PARAMETERS

4.1 Agriculture, Forestry, and Livestock Sectors

This chapter presents land and soil characteristics and practical methods to estimate these characteristics in the field, as well as the criteria for their classification.

A. Temperature

In locations where temperature data are not available due to limited recording stations, air temperature can be estimated from elevation above sea level. The estimation uses Braak's formula (1928 in Mohr *et al.*, 1972). Braak's formula is as follows:

$$26,3\text{ }^{\circ}\text{C} - (0,01 \times \text{elevation in meter} \times 0,6\text{ }^{\circ}\text{C})$$

B. Soil Drainage

Soil drainage classes are differentiated into seven classes:

- 1) **Excessively Drained**, Soils with high to very high hydraulic conductivity and low water holding capacity. Such soils are not suitable for crops without irrigation. A field indicator is a homogeneous soil color without mottles or concretions of iron and aluminum, and without grey (reduced) colors.
- 2) **Somewhat Excessively Drained**, Soils with high hydraulic conductivity and low water holding capacity. These soils are suitable only for some crops without irrigation. A field indicator is a homogeneous soil color without mottles or concretions of iron and aluminum, and without grey (reduced) colors.
- 3) **Well Drained**, Soils with moderate hydraulic conductivity and moderate water holding capacity, moist but not wet near the surface. These soils are suitable for a wide range of crops. A field indicator is a homogeneous soil color without mottles or concretions of iron and/or manganese and without grey (reduced) colors down to a depth of ≥ 100 cm.

- 4) ***Moderately Well Drained***, Soils with moderate to somewhat low hydraulic conductivity and low water holding capacity, wet near the surface. These soils are suitable for a wide range of crops. A field indicator is a homogeneous soil color without mottles or concretions of iron and/or manganese and without grey (reduced) colors down to a depth of ≥ 50 cm.
- 5) ***Somewhat Poorly Drained***, Soils with somewhat low hydraulic conductivity and low to very low water holding capacity, wet up to the surface. These soils are suitable for irrigated rice and a limited number of other crops. A field indicator is a homogeneous soil color without mottles or concretions of iron and/or manganese and without grey (reduced) colors down to a depth of ≥ 25 cm.
- 6) ***poorly drained***, Soils with low hydraulic conductivity and low to very low water holding capacity, wet for a relatively long period up to the surface. These soils are suitable for irrigated rice and a limited number of other crops. A field indicator is a grey (reduced) soil color with few mottles or concretions of iron and/or manganese in layers up to the surface.
- 7) ***very poorly drained***, Soils with very low hydraulic conductivity and very low water holding capacity, permanently wet and ponded for a long period up to the surface. These soils are suitable for irrigated rice and a limited number of other crops. A field indicator is a permanent grey (reduced) soil color extending to the surface layer.

C. Soil Texture

Soil texture is the relative proportion of sand, silt, and clay particles. **Figure 4.1** presents texture determination based on the proportions of sand, silt, and clay using the soil texture triangle. Texture can also be determined in the field, as presented in **Table 4.1**.

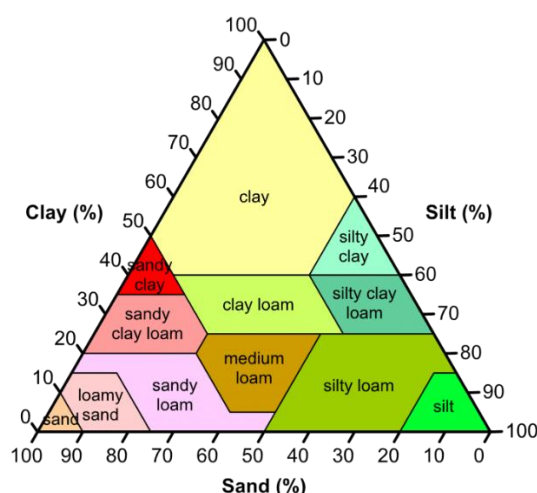


Figure 4.1 Soil Texture Triangle

Table 4.1 Field determination of soil texture

No	Texture Class	Soil Properties
1	Sand (S)	Very extremely coarse feel, does not form a ball or a roll, and is non-sticky.
2	Loamy Sand (LS)	Very coarse feel, forms a ball that crumbles very easily, and is slightly sticky.
3	Sandy Loam (SL)	Rather coarse feel, forms a somewhat strong ball but crumbles easily, and is slightly sticky.
4	Loam (L)	Neither coarse nor slippery, forms a firm ball, can be rolled slightly with a glossy surface, and is sticky.
5	Silt Loam (SiL)	Smooth feel, forms a firm ball, can be rolled slightly with a glossy surface, and is slightly sticky.
6	Silt (Si)	Very smooth feel, forms a firm ball, can be rolled slightly with a glossy surface, and is slightly sticky.
7	Clay Loam (CL)	Rather coarse feel, forms a somewhat firm ball (moist), can be rolled but breaks easily, and is slightly sticky.
8	Sandy Clay Loam (SCL)	Distinctly coarse feel, forms a somewhat firm ball (moist), can be rolled but breaks easily, and is sticky.
9	Silt Clay Loam (SiCL)	Distinctly smooth feel, forms a firm ball, roll has a glossy surface, and is sticky.
10	Sandy Clay (SC)	Slightly smooth and slightly coarse feel, forms a ball that, when dry, is difficult to twist, easy to roll, and is sticky.
11	Silt Clay (SiC)	Rather smooth feel, forms a ball that, when dry, is difficult to twist, easy to roll, and is sticky.
12	Clay (C)	Heavy feel, forms a perfect ball, very hard when dry, and very sticky when wet.

Source: Ritung *et al.*, (2011)

The textural groupings used in this Technical Guideline are:

Fine	: Sandy clay, clay, silty clay
Somewhat Fine	: Clay loam, sandy clay loam, silty clay loam
Moderate	: Very fine sandy loam, loam, silt loam
Somewhat Coarse	: Sandy loam
Coarse	: Sand, loamy sand
Very Fine	: Clay (2:1 clay mineral type)

D. Coarse Fragment

Coarse fragments are texture modifiers determined by the percentage of gravel (0.2 to 7.5 cm), cobbles (7.5 to 25 cm), or stones (> 25 cm) in each soil layer. The percentage of coarse fragments is classified as follows:

Few	: < 15 %
Moderate	: 15-35 %
Many	: 35-60 %
Very Many	: >60 %

E. Soil Depth

Soil Depth is classified as follows:

Very Shallow	: < 20 cm
Shallow	: 20-50 cm
Moderate	: > 50-75 cm
Deep	: > 75 cm

F. Peat Thickness

Peat thickness is classified as follows:

Thin	: < 50 cm
Moderate	: 50-100 cm
Rather Thick	: >100-200 cm
Thick	: >200-300 cm
Very Thick	: >300 cm

G. Alkalinity

Alkalinity represents the amount of bases contained in water. It is determined based on the exchangeable sodium percentage (%), defined as:

$$ESP = \frac{\text{exchangeable Na}}{\text{Soil CEC}} \times 100$$

An ESP value of 15 % is equivalent to a sodium adsorption ratio (SAR) value of 13. According to Arsyad (2010), SAR can be determined using the following equation:

$$SAR = \frac{Na^{+}}{\sqrt{\frac{Ca^{++} + Mg^{++}}{2}}}$$

H. Erosion Hazard

Erosion hazard level can be predicted based on field conditions by observing the occurrence of sheet erosion, rill erosion, and gully erosion. Another approach that is relatively easier to apply is to assess the average annual loss of the soil surface compared with non-eroded soil, which is characterized by the presence of the A horizon. The A horizon is usually characterized by a dark color because it relatively contains a high amount of organic matter. The erosion hazard levels are presented in **Table 4.2**.

Table 4.2 Matrix for determining erosion hazard level

Erosion Hazard Level	Amount of Surface Soil Lost (cm/year ⁻¹)
Very Slight	< 0,15
Slight	0,15 - 0,9
Moderate	0,9 - 1,8
Severe	1,8 - 4,8
Very Severe	> 4,8

Source: Ritung *et al.*, (2011)

I. Cultivation Slope Limit

The upper slope limit for agricultural cultivation is determined by considering the sustainability of farming activities and the associated environmental risks. To maintain land stability and prevent ecosystem degradation, the allowable slope gradient for agricultural cultivation activities is set at 40 %.

J. Nutrient Availability

The nutrients evaluated for their availability are Total Nitrogen, Available Phosphorus, and Available Potassium. These three nutrients are macronutrients and are taken up in the largest amounts by crops. The criteria for evaluating available nutrients in the soil refer to **Table 4.3**

Table 4.3 Criteria for soil fertility evaluation (Sulaiman *et al.*, 2023).

Soil Property	Very Low	Low	Medium	High	Very High
Organic Carbon (%)	< 1,00	1,00-2,00	2,01-3,00	3,01-5,00	> 5,00
Total Nitrogen (%)	< 0,10	0,10-0,20	0,21-0,50	0,51-0,75	>0,75
C/N ratio	< 5	5-10	11-15	16-25	> 25
P ₂ O ₅ HCl 25 % (mg/100gr)	< 15	15 – 20	21 – 40	41 – 60	> 60
K ₂ O HCl 25 % (mg/100gr)	< 10	10 – 20	21 – 40	41 – 60	> 60
P ₂ O ₅ Bray (ppm)	< 10	10 – 15	16 – 25	26 – 35	> 35
P ₂ O ₅ Olsen (ppm)	< 10	10 – 25	26 – 45	46 – 60	> 60
CEC (cmol(+)/kgliat)	< 5	5 – 16	17 – 24	25 – 40	> 60
Cation Composition:					
K (cmol(+) kg ⁻¹)	< 0,1	0,1-0,3	0,4-0,5	0,6-1,0	>1,0
Na (cmol(+) kg ⁻¹)	< 0,1	0,1-0,3	0,4-0,7	0,8-1,0	>1,0
Mg (cmol(+) kg ⁻¹)	< 0,3	0,3-1,0	1,1-2,0	2,1-8,0	>8,0
Ca (cmol(+) kg ⁻¹)	< 2	2-5	6-10	11-20	>20
Base Saturation (%)	< 20	20-40	41-60	61-80	81-100
Aluminium Saturation (%)	< 5	5-10	11-20	20-40	>40
Salinity (EC) Ece x 10 ³ (dS/M)	<1	1-2	2-3	3-4	>4
Exchangeable Sodium Percentage (ESP)	< 2	2-5	5-10	10-15	>15

pH (H ₂ O)	Very Acidic	Acidic	Slightly Acidic	Neutral	Slightly Alkaline	Alkaline
	< 4,5	4,5-5,5	5,6 – 6,5	6,6-7,5	7,6 – 8,5	>8,5

*) This evaluation is based only on general empirical soil properties and has not yet been related to crop requirement.

4.2 Fisheries Sector

In this subsection, land characteristics and practical methods for measuring them in the field are described, along with the criteria for their classification.

A. Topography

The topography of a site influences the filling and exchange of pond water, especially in traditional and semi-intensive ponds. Coastal land is generally flat, but its elevation is important for pond efficiency. Elevation that is too high or too low makes it difficult to fill and drain pond water. Ideally, pond elevation allows minimal excavation, low construction costs, and maintenance of soil fertility. Bose *et al.* (1991) state that the ideal pond bottom is one that can be drained and filled by gravity within 5 days in each tidal cycle.

B. Soil Conditions

Changes in soil properties are time dependent. Chemical and physical weathering, even under ideal conditions, requires hundreds or even thousands of years to develop into mature soil. Therefore, in selecting soil quality criteria for pond aquaculture, variables are chosen that have a strong influence on pond culture but are stable or relatively difficult to change.

In pond construction, excavation is required so that the constructed pond can retain water; therefore, the depth of soil that can be excavated becomes an important consideration. Soil depth in this context refers to the thickness of the pond soil from the ground surface down to the hard, compact layer. For vannamei shrimp ponds, the pond should ideally be excavated to at least 2.0 m, because the optimal pond water depth for vannamei shrimp culture is between 1.5–1.8 m. For black tiger shrimp culture, the required water depth is between 1.0–1.2 m, while shallower depths of 0.5–1.0 m are used for milkfish and Nile tilapia culture.

1. Clay Percentage

Soil texture is the proportion of clay, silt, and sand fractions in the soil. Pond soil texture strongly influences porosity and the development of klekap (benthic algal mats), which can be one of the food sources for fish and shrimp. Ponds with coarse-textured soils such as sand and loamy sand have high porosity; as a result, the ponds cannot retain water. Pond soils are often fine textured with a minimum clay content of 20–30 % to prevent lateral seepage (Boyd, 1995). Soil textures suitable for ponds include clay, clay loam, silty clay loam, silt loam, loam, and sandy clay loam (Ilyas *et al.*, 1987).

2. $pH_F - pH_{FOX}$

pH_F is soil pH measured directly in the field, whereas pH_{FOX} is soil pH measured in the field after oxidation with 30 % hydrogen peroxide. Both are characteristic variables of acid sulfate soils. The difference between pH_F and pH_{FOX} ($pH_F - pH_{FOX}$) can be used as an indicator of the magnitude of potential acidity in acid sulfate soils. In this case, the greater the $pH_F - pH_{FOX}$ value, the greater the potential acidity in the acid sulfate soil.

3. Organic Carbon

Organic matter in ponds can affect soil stability, oxygen consumption, nutrient source, and the suitability of the pond bottom as habitat. In the surface layer (0–0.2 m) of mineral soils used for agriculture, organic matter content rarely reaches 5–6 %, and in tropical and subtropical regions, the organic matter content is usually lower (Boyd, 1995). In soils with high clay content (> 60 %), Boyd (1995) considers organic matter content < 8 % as slight, meaning favorable, and the limiting factors are easily overcome for pond aquaculture. However, very high organic matter content can deteriorate the pond culture environment. Its decomposition may produce toxic compounds, which is a negative impact of excessive organic matter.

C. Water Quality

Water quality is an important factor in the success of pond culture because the commodities are living in the water body itself. Water quality is considered suitable for pond culture if it can support the life of aquatic organisms and their food organisms at every stage of rearing. The key water quality variables for pond culture are transparency, temperature, salinity, pH, and NH_3 .

1. Temperature (°C)

As a tropical country, Indonesia does not experience large seasonal temperature fluctuations. The fluctuations that may cause problems are diurnal temperature variations. The temperature difference between day and night can be as high as 10 °C, especially in shallow ponds. Suitable water temperature for black tiger shrimp culture ranges from 26 °C to 32 °C, with an optimum of 29 °C to 30 °C (Poernomo, 1988). The optimal temperature for vannamei shrimp growth is 28 °C–30 °C (Ponce-Palatox *et al.*, 1997). Suitable water temperature for milkfish is 27 °C–31 °C (Ismail *et al.*, 1993). The optimal water temperature for Nile tilapia culture is 25 °C–30 °C (Stickney, 2000; Hossain *et al.*, 2007), and this species can tolerate temperatures between 15 °C and 37 °C (Wiryanta *et al.*, 2010).

2. Salinity (ppt)

Salinity is the total amount of solid material in grams contained in one kilogram of seawater when all carbonates are converted to oxides, bromide and iodide are replaced by chloride, and all organic matter is completely oxidized (Boyd, 1995). The direct effect of salinity on aquatic organisms is exerted through its influence on the osmotic pressure and composition of body fluids (Poxton, 2003). In coastal waters, salinity is strongly influenced by freshwater input from rivers. Black tiger shrimp, vannamei shrimp, milkfish, and Nile tilapia are euryhaline organisms; however, because they are cultured for commercial purposes, optimal salinity ranges must be maintained. Black tiger shrimp can adapt to salinity levels of 3–45 ppt, but optimal growth requires water salinity of 15–25 ppt (Poernomo, 1988). Vannamei shrimp generally grow optimally at a salinity of 15–20 ppt (Bray *et al.*, 1994). Milkfish can grow optimally at salinity levels of 15–30 ppt (Ismail *et al.*, 1993). Nile tilapia can live across a wide salinity range, so it can be cultured in two different ecosystems, namely freshwater and brackish water (Watanabe, 2000; Hossain *et al.*, 2007).

3. pH

The tolerance limits of aquatic organisms to pH vary and are influenced by many factors, including temperature, dissolved oxygen, alkalinity, the presence of anions and cations, as well as species and life stage. The suitable pH range for black tiger shrimp is 7.5–8.7, with an optimum of 8.0–8.5 (Poernomo, 1988). Milkfish grow optimally at a water pH of 7.0–8.5 (Ismail *et al.*, 1993). According to Swingle (1968), in general, a water pH of 6.5–9.0 is suitable for aquatic organisms; at pH 9.5–11.0 and 4.0–6.0, production is low, and if the pH is lower than 4.0 or higher than 11.0, it becomes lethal to fish.

4. Total Dissolved Solid (TDS)

The tolerance limits of aquatic organisms to pH vary and are influenced by many factors, including temperature, dissolved oxygen, alkalinity, the presence of anions and cations, as well as species and life stage. The suitable pH range for black tiger shrimp is 7.5–8.7, with an optimum of 8.0–8.5 (Poernomo, 1988). Milkfish grow optimally at a water pH of 7.0–8.5 (Ismail *et al.*, 1993). According to Swingle (1968), in general, a water pH of 6.5–9.0 is suitable for aquatic organisms; at pH 9.5–11.0 and 4.0–6.0, production is low, and if the pH is lower than 4.0 or higher than 11.0, it becomes lethal to fish.

5. Ammonia (mg/L)

Ammonia may occur in molecular form (NH_3) or as the ammonium ion (NH_4^+), with NH_3 being more toxic than NH_4^+ (Poernomo, 1988). NH_3 can pass through cell membranes more rapidly than NH_4^+ . Ammonia concentrations of 0.05–0.20 mg/L already inhibit the growth of most aquatic organisms. When NH_3 exceeds 0.2 mg/L, the water becomes toxic to some fish species (Sawyer & McCarty, 1978). Chanratchakool *et al.* (1995) state that the permissible ammonia concentration for black tiger shrimp culture is less than 0.1 mg/L. According to Stickney (2000), Nile tilapia is relatively tolerant of high ammonia concentrations. However, fish cannot tolerate excessively high NH_3 levels because they interfere with oxygen binding by the blood and ultimately can lead to suffocation.

6. Dissolved Oxygen (DO)

Dissolved Oxygen (DO) is the concentration of oxygen dissolved in water, derived from diffusion from the atmosphere and from photosynthesis by aquatic plants (Manik, 2003). Every organism requires DO to carry out respiration and to optimize growth. DO requirements vary according to species and their biological activity (Gemilang *et al.*, 2017). Oxygen also plays an important role in the oxidation of organic and inorganic compounds under aerobic conditions. Effendi (2003) explains that oxygen solubility decreases with increasing temperature and salinity; therefore, oxygen concentrations in marine environments are lower than in freshwater systems.

D. Climate

The long-term average condition of weather over an extended period is known as climate. The climate variable that is important for pond aquaculture is rainfall. Annual rainfall between 2,000 and 3,000 mm with 2–3 dry months is adequate for ponds (Mustafa *et al.*, 2011). A dry month, according to the climate classification of Schmidt & Ferguson (1951), is a month with rainfall < 60 mm.

Pond preparation is one of the activities that must be carried out before stocking. During pond preparation, the pond is dried with the aim of improving soil physical properties, increasing mineralization of organic matter, and eliminating toxic substances such as hydrogen sulfide, ammonia, and methane. Therefore, specific dry months are required each year. Annual rainfall (mm/year) soils have high to very high hydraulic conductivity and low water-holding capacity. Such soils are not suitable for crops without irrigation. A field indicator is a homogeneous soil color without mottles or concretions of iron and aluminum and without grey (reduced) colors.

V. EXAMPLE OF LAND EVALUATION

5.1 Land Suitability Assessment

This chapter provides an example of land suitability assessment at the semi-detailed mapping level. The soil and physical environmental data used are the results of semi-detailed identification and characterization at a scale of 1:50,000 in the Lombok area (Puslittanak, 1990). An example of land suitability assessment for an agricultural commodity is presented in **Table 5.1**, in the form of a semi-detailed land suitability assessment for maize (Harapan variety), while for a fisheries commodity, an example of land suitability assessment for Nile tilapia (*Oreochromis niloticus*) culture with medium management level at the same semi-detailed mapping level is presented in **Table 5.2**.

Table 5.1 Land suitability assessment for maize, Harapan variety

Land Quality/Characteristic	Data Value	Rating and actual land suitability class		Improvement Measures	Rating and potential land suitability class	
Temperature (tc) - Average annual temperature	22°C	S1	S1		S1	S1
Water Availability (wa) - Annual Rainfall	2.625 mm	S1	S1		S1	S1
Rooting Condition (rc) - Drainage - Texture - Coarse Fragment - Soil Effective Depth - Peat: a) Maturity b) Thickness	Somewhat Excessively Sandy Loam - Deep Non-Peat	S3 S2 S1 - -	S3	+	S2 S2 S1 - -	S2
Nutrient Retention (nr) - CEC - BS - pH - SOC	Low - 6,1 -	S2 - S1 -	S2	+	S1 - S1 -	S1
Nutrient Availability (na) - Total Nitrogen - Available Pottasium - Available Phosphorus	Low High Medium	S2 S1 S1	S2	+	S1 S1 S1	S1
Toxicity (xc) - Salinity		S1	S1			S1
Sodicuty (xn) - Alkalinity						
Sulfidic Hazarddd (xs) - Pyritic depth	-	S1	S1		S1	S1

Erosion Hazard (eh) - Slope - Erosion Hazard Level	2 % Low	S1 S1	S1	+	S1 S1	S1
Flood Hazard (fh) - High - Duration	Never	S1 S1	S1		S1 S1	S1
Land Preparation (lp) - Surface Rock - Rock Outcrops	0 % 0 %	S1 S1	S1		S1 S1	S1
Overall assessment	Actual (A)		S3	+	Potential	S2

5.2 Interpretation of Land Evaluation Results

The results of land evaluation using the above procedure consist of the actual land suitability class and the potential land suitability class. The actual land suitability class represents the suitability of the land based on soil survey or land resource data without considering the improvements required to overcome constraints or limiting factors related to crop growth requirements or the needs of aquaculture systems. Such land may be undeveloped, not yet cultivated, or already used for agriculture but not optimally or intensively managed. Considering existing constraints, the land still has potential that can be improved.

The potential land suitability class represents the condition expected to be achieved when improvement measures are implemented. Any improvement effort must take economic aspects into account. Improvements to address limitations should be undertaken only if they are economically feasible and can provide benefits. Potential land suitability reflects the anticipated land condition for agricultural and aquaculture development, allowing land-use planning to be formulated more strategically and profitably.

Land evaluation results can serve as a basis for selecting alternative commodities to be developed in each subsector. In choosing commodities, in addition to considering their land suitability class, the economic market potential of the commodities must also be taken into account. For example, in the agricultural sector, an area may be marginally suitable (S3) for soybean, moderately suitable (S2) for cassava, and highly suitable (S1) for cassava. In this situation, soybean may still be prioritized for development because it has better market prospects, higher prices, and a shorter growing period, making it more profitable. Similarly, in the fisheries sector, an area may be marginally suitable (S3) for crab culture, moderately

suitable (S2) for milkfish, and highly suitable (S1) for milkfish. In such a case, milkfish would be prioritized due to its better market prospects, higher prices, and shorter production cycle, offering greater economic advantages.

The same approach applies to other commodities. Selection of commodities to be developed in a given area must not only consider the land suitability class but also require farm or aquaculture enterprise analysis, market analysis, and socio-economic considerations of local communities, all of which must be evaluated in an integrated manner. Through this integrated approach, the results of actual and potential land suitability evaluations can be optimally utilized to support sustainable, productive, and economically viable agricultural and aquaculture development planning.

VI. GUIDELINES FOR THE PRODUCTION AND USE OF FERTILIZERS

Fertilization is a fundamental component of soil fertility management and agricultural production systems because it plays a critical role in supplying the nutrients required by crops to support growth and yield. Soil as a growing medium has a limited capacity to supply nutrients naturally, particularly on land managed intensively and continuously. Declines in soil nutrient availability may occur due to nutrient uptake by crops, erosion, leaching, and reductions in soil organic matter, which together lead to a decrease in soil fertility status. Therefore, fertilization constitutes a strategic effort to maintain and enhance the soil's carrying capacity in support of productive and sustainable agricultural systems.

Fertilization practices that are not based on crop nutrient requirements and suboptimal soil conditions that limit nutrient-use efficiency can trigger various environmental problems, including the accumulation of specific nutrients, water pollution, and deterioration of soil quality. In contrast, well-planned fertilization grounded in scientific principles can improve fertilizer-use efficiency, enhance the physical, chemical, and biological properties of soil, and support long-term stability of agricultural production.

The general principles of balanced and sustainable fertilization emphasize the alignment between fertilizer type and application rate with crop requirements, soil nutrient status, and local environmental characteristics. Each crop has different macro- and micronutrient requirements at each growth stage; therefore, fertilization must be tailored specifically and proportionally. Evaluation of soil conditions, through both field observations and laboratory analyses, forms the basis for determining fertilization strategies so that nutrient inputs are applied efficiently without causing nutrient imbalances.

Organic fertilizers, such as manure, compost, and organic fertilizers derived from local biomass, play an important role in increasing soil organic matter content, improving soil structure and aggregation, and enhancing soil microbial activity. Improvements in these properties contribute to greater soil capacity to retain water and nutrients, thereby supporting more

stable crop growth. Meanwhile, the application of balanced fertilization aims to ensure adequate and balanced availability of essential nutrients according to crop needs and to prevent deficiencies or excesses of particular nutrients.

The balanced integration of organic and inorganic fertilizers represents a relevant approach to achieving sustainable agricultural systems because it can optimize land productivity while maintaining environmental quality. These guidelines are prepared as an academic and technical reference for the production and use of various fertilizer types so that they can be implemented systematically, measurably, and responsibly in agricultural land management.

6.1 Manure

A. Definition, Characteristics, and Benefits of Manure

Manure is an organic fertilizer derived from livestock excreta that has been processed through decomposition, making it safe and suitable for use as a nutrient source for crops. It generally contains primary macronutrients, namely nitrogen (N), phosphorus (P), and potassium (K), as well as micronutrients in limited amounts. The characteristics and quality of manure are influenced by livestock type, feed, and the degree of maturity prior to application. In addition to serving as a nutrient source, manure plays an important role as a supplier of organic matter that supports improvements in soil quality (Havlin *et al.*, 2014).

Sustained application of manure has been shown to increase soil organic carbon content, improve soil structure and aggregation, and enhance the soil's capacity to retain water and nutrients (Diacono & Montemurro, 2010). Manure also contributes to increased soil microbial activity that supports nutrient mineralization and maintains overall soil health (Edmeades, 2003). According to the Regulation of the Minister of Agriculture No. 28/Permentan/SR.130/5/2009, high-quality solid manure must have an organic carbon content >15 %, a C/N ratio of 15 to 25, and a total macronutrient content (N, P₂O₅, and K₂O) of 4 %.

B. Types of Manure

Manure can be differentiated based on livestock source, as each type of livestock produces manure with distinct physical characteristics and nutrient contents. These differences are primarily influenced by feed type, husbandry system, and the proportion of feces and urine contained in the manure. In general, manure nutrient contents fall within certain ranges, as presented in the following table.

Table 6.1 Results of Nutrient Content Analysis of Several Types of Manure

Source	N	P	K	Ca	Mg	S	Fe
Dairy Cattle	0,53	0,35	0,41	0,28	0,11	0,05	0,004
Beef Cattle	0,65	0,15	0,30	0,12	0,10	0,09	0,004
Horse	0,70	0,10	0,58	0,79	0,14	0,07	0,010
Poultry	1,50	0,77	0,89	0,30	0,88	0,00	0,100
Sheep	1,28	0,19	0,93	0,59	0,19	0,09	0,020

Source : Tan (1993)

C. Techniques for Manure Production

Manure is not recommended for use in its raw form because it remains unstable and may cause negative impacts on crops and soil. Fresh manure generally has a high C/N ratio, particularly cattle manure, which can lead to nitrogen immobilization and reduced nutrient availability for crops during early growth stages (Havlin *et al.*, 2014). In addition, raw manure may contain phytotoxic compounds and pathogenic microorganisms that pose risks to crop growth and environmental quality (Edmeades, 2003).

Therefore, manure should undergo composting prior to application. Composting aims to stabilize organic matter, reduce the C/N ratio, eliminate offensive odors, suppress pathogen populations, and increase nutrient availability for crops. Agus *et al.* (2014) reported that composted manure exhibits improved and more stable chemical and biological properties, does not undergo reheating, and is safe for application to agricultural land.

The composting process for manure can be conducted naturally or with the addition of starter microbes or decomposers. Natural composting requires a relatively long period, generally more than three months, whereas the use of starter microbes can accelerate processing to approximately two to four

weeks. Proper and controlled use of starter microbes has been shown to improve the nutritional quality of manure compost and reduce pathogen content with increasing incubation time (Agus *et al.*, 2014). Composting should be carried out under aerobic conditions or moist but not anaerobic conditions to prevent the formation of reduced sulfur compounds such as H₂S, which produce unpleasant odors and may be harmful to crops.

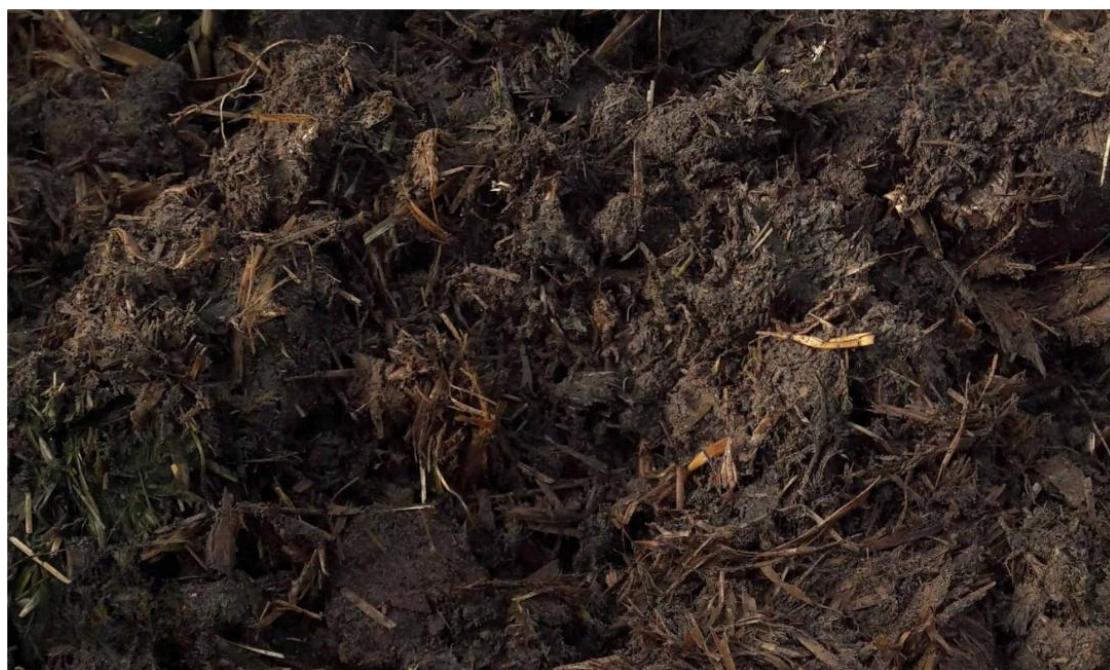


Figure 6.1 Manure
(Source: Mitra Bertani, 2025)

D. Application Rates of Manure

Putra *et al.* (2023) reported that in maize (*Zea mays* L.), the application of manure at rates of 30 to 40 t ha⁻¹ prior to planting significantly increased dry grain yield at harvest. The highest yield increase reached more than twofold compared with the treatment without manure, which was primarily associated with improvements in soil chemical properties and enhanced soil fertility.

In potato (*Solanum tuberosum* L.), Kantikowati *et al.* (2020) found that the application of poultry manure at rates of 10 to 15 t ha⁻¹ before planting produced the best response in vegetative growth and tuber yield. This response was indicated by increases in leaf number, tuber number, and

tuber weight per plant.

Similar results were also reported for watermelon (*Citrullus lanatus*), where Masriyana *et al.* (2021) stated that the application of either poultry or cattle manure at a rate of approximately 20 t ha⁻¹ during land preparation enhanced plant growth and yield components, including the number of female flowers, fruit length, and fruit diameter.

6.2 Compost

A. Definition, Characteristics, and Benefits of Compost

Compost is a solid fertilizer produced through the decomposition of organic materials, primarily plant residues and or mixtures of animal-derived organic materials, which occurs biologically through the activity of microorganisms under controlled conditions. Compost feedstocks commonly include leaves, straw, cogon grass, weeds, and agricultural wastes, and they may be combined with livestock manure as a nitrogen source; however, the final product is classified as compost rather than manure (Diaz *et al.*, 2007; Imas & Munir, 2017).

Technically, composting is an aerobic biodegradation process of heterogeneous organic materials by mesophilic and thermophilic microbial populations until a relatively stable, mature material is formed that is safe for soil application. Mature compost is characterized by a dark brown to black color, a crumbly texture, the absence of offensive odors, a temperature close to ambient conditions, and a low and stable C/N ratio (Soepardi, 1983; Murbandono, 1995).

Compost contains macronutrients such as nitrogen (N), phosphorus (P), and potassium (K), as well as essential micronutrients including Fe, Mn, Zn, Cu, B, Mo, and Cl, which are required by plants in small amounts but play important roles in plant physiological processes (Imas & Munir, 2017; Kakabouki *et al.*, 2020). In addition to serving as a nutrient source, compost functions to increase soil organic matter content, improve soil structure and aggregation, enhance water-holding capacity, and support soil microbial activity. Consequently, compost application directly contributes to improved soil fertility and the sustainability of agricultural systems (Setjamidjaja, 1994; Murbandono, 1995).

B. Techniques for Compost Production Based on the Weed *Chromolaena odorata*

Intensive and continuous use of inorganic fertilizers without adequate organic matter inputs has led to soil quality degradation, as indicated by declines in soil organic matter, increased soil acidity, and reduced land productivity (Jamilah *et al.*, 2024). One alternative for sustainable fertilization is the utilization of local resources such as the weed *Chromolaena odorata*, which is known as an invasive species but contains relatively high levels of organic matter, nitrogen, phenolic compounds, and minerals (Oseni & Akindele, 2018).

Through composting, *Chromolaena odorata* can be processed into solid compost or fermented liquid fertilizer, thereby not only reducing the negative impacts of weeds on agricultural land but also producing environmentally friendly and useful fertilizer inputs (Myo Win, 2023; Likuayang *et al.*, 2023).



Figure 6.2 *Chromolaena odorata* Plant
(Source: Researcher Documentation, 2025)

1. Decomposition Process

The composting of *Chromolaena odorata* is a biological process involving microbial activity that decomposes plant tissues into simpler and more stable organic compounds. During the initial stage, known as the mesophilic phase, microorganisms utilize readily degradable organic compounds such as sugars and proteins, leading to increased biological activity and a decrease in pH due to the formation of organic acids (Jamilah *et al.*, 2024).

Subsequently, the process enters the thermophilic phase, which is characterized by an increase in temperature to 55 to 70 °C. This phase plays an important role in accelerating the decomposition of complex compounds such as cellulose and lignin and is effective in suppressing pathogen populations and destroying weed seeds (Ikuenobe & Anoliefo, 2003). After thermophilic microbial activity declines, the pile temperature gradually decreases and enters the cooling phase, during which actinomycetes contribute to the continuation of the humification process. The final stage is the maturation phase, which produces mature compost with stable physical and chemical properties, a dark color, no odor, and a C/N ratio < 15, making it safe and ready for application to agricultural land (Oseni & Akindele, 2018).

In addition to solid compost, *Chromolaena odorata* can also be processed into liquid fertilizer through anaerobic fermentation using microbial activators. This liquid fertilizer product is rapidly available and is generally used as a supplementary fertilizer through drenching or foliar application after dilution (Myo Win, 2023).



Figure 6.3 Compost Production Process

2. Compost Production Procedures

Materials and Equipment

- 1) Fresh *Chromolaena odorata* weeds (leaves and young stems), approximately 1000 kg.
- 2) Probiotics or decomposers (EM4, local microorganisms, or *Primadec* C-15), approximately 4 kg.
- 3) Urea, approximately 4 kg, used as an activator.
- 4) Water as required.
- 5) Buckets, shovels, plastic drums, watering cans.

Solid Composting Procedure

- 6) Chop the weeds into small pieces measuring 2 to 5 cm.
- 7) Spread the chopped material on a prepared floor to a thickness of approximately 30 to 40 cm.
- 8) Evenly apply the decomposer and urea.
- 9) Maintain moisture content at 45 to 55 % through watering.
- 10) Build subsequent layers until the pile reaches a height of 100 to 150 cm.
- 11) Cover tightly and allow to stand for one week.
- 12) Turn the pile weekly, three times in total, while adding water if necessary.
- 13) After 4 to 6 weeks, the mature compost is ready for use.

Liquid Fertilizer Production Procedure

- 1) Place the chopped weeds into a plastic drum.
- 2) Add water at a ratio of 1:3 (material:water).
- 3) Add EM4 or local microorganisms at approximately 100 mL per 10 L of mixture.
- 4) Seal tightly and ferment for 10 to 14 days, stirring every 2 to 3 days.
- 5) Filter and collect the liquid as organic liquid fertilizer.
- 6) Application: dilute at a ratio of 1:10 before applying to crops.

Application Rates of Organic Fertilizer Derived from *Chromolaena odorata*

The results reported by Jamilah *et al.* (2024) showed that the application of liquid fertilizer derived from *Chromolaena odorata* at a concentration of 100 mL L⁻¹ water increased soil pH, thereby making soil conditions more suitable for maize growth. Improvements in soil fertility

quality had a positive effect on crop productivity, which reached 9.38 t ha⁻¹.

In green mustard, application of the liquid fertilizer at the same concentration resulted in the best growth performance, as indicated by increases in plant height and biomass (Likuyang *et al.*, 2023). For solid compost, the recommended application rate ranges from 10 to 20 t ha⁻¹, particularly for improving soil physical properties and increasing nutrient availability (Oseni & Akindele, 2018).

3. Points to Be Considered

The success of the composting process is strongly influenced by pile height, moisture content, and the degree of compost maturity. A pile that is too low prevents temperatures from reaching the thermophilic phase, resulting in the survival of weed seeds and pathogens. Excessive moisture can inhibit aeration and slow the decomposition process. Compost is considered mature when it is dark brown to black in color, has a crumbly texture, is free of unpleasant odors, and has a C/N ratio ranging from 10 to 25. In the use of liquid fertilizer, dilution is mandatory to avoid phytotoxic or allelopathic effects.

6.3 Balanced Fertilization

A. Definition and Principles of Balanced Fertilization

Balanced fertilization refers to the application of fertilizers to soil with the objective of supplying essential nutrients in a balanced and optimal manner according to crop requirements and soil fertility status, thereby sustainably improving agricultural productivity and product quality while maintaining environmental quality.

The core principle of balanced fertilization is known as the Five Right concept (5R), which comprises the right type, right rate, right time, right method, and right form of fertilizer. These five principles are interrelated and serve as the foundation for improving fertilizer-use efficiency and preventing nutrient imbalances in soil.

1. Right Type

The right type of fertilizer refers to the selection of fertilizer types that match crop nutrient requirements and soil conditions. Each crop requires a specific combination of macro- and micronutrients in differing amounts; therefore, fertilizer selection must be based on soil analysis

results, observed nutrient deficiency symptoms, and the characteristics of the cultivated crop. The use of inappropriate fertilizer types may result in fertilizer waste and nutrient imbalance.

2. Right Rate

The right fertilizer rate relates to the amount of fertilizer applied in accordance with crop demand and the soil's capacity to supply nutrients. Excessive fertilizer application, particularly of N, P, and K, may reduce fertilization efficiency, suppress the availability of micronutrients, and increase the risk of environmental pollution. Conversely, application rates that are too low can cause nutrient deficiencies and reduce crop yields.

3. Right Time

The right timing of fertilizer application emphasizes alignment between the timing of nutrient supply and crop growth stages. Crop nutrient requirements vary across growth phases; therefore, fertilizers should be applied when crops are able to absorb nutrients optimally. Fertilizer application at inappropriate times may result in nutrient losses through leaching, volatilization, or fixation in soil.

4. Right Method

The right application method concerns the manner in which fertilizers are applied to ensure efficient nutrient utilization by crops. Application methods may include broadcasting, placement in furrows or planting holes, split applications, or foliar application, depending on fertilizer type and crop characteristics. Appropriate application methods can reduce nutrient losses and increase the effectiveness of nutrient uptake by plant roots.

5. Right Form

The right fertilizer form or formulation refers to the selection of appropriate fertilizer forms, whether single-nutrient fertilizers, compound fertilizers, or controlled-release fertilizers. The choice of fertilizer form should be adjusted to crop requirements, soil properties, and the cultivation system applied. The use of appropriate fertilizer formulations can enhance fertilization efficiency and support sustained nutrient availability.

B. Types of Fertilizers

Inorganic fertilizers are sources of essential nutrients used to improve soil fertility and crop productivity. Each fertilizer type contains different nutrients that serve specific functions according to plant physiological requirements.

1. Urea

Urea is the most widely used inorganic fertilizer in modern agricultural systems. Its primary nutrient is nitrogen (approximately 46 %), which plays a crucial role in stimulating vegetative growth, particularly leaf and stem development. Nitrogen from urea enhances chlorophyll synthesis, thereby optimizing photosynthesis, and supports protein formation that strengthens plant tissues. However, because urea is highly soluble in water, it is susceptible to leaching by rainfall or excessive irrigation; therefore, its use must be adjusted to crop requirements and soil conditions to avoid environmental pollution.

2. Ammonium Sulfate (ZA)

Ammonium sulfate is a fertilizer containing nitrogen (approximately 21 %) and sulfur (approximately 24 %). The combination of these two nutrients provides dual benefits to crops. Nitrogen supports vegetative growth, while sulfur plays a role in chlorophyll formation, enzyme activity, and the improvement of grain and yield quality. Ammonium sulfate also contributes to improving soil fertility, particularly in sulfur-deficient soils. However, its acidifying effect requires careful use, especially on soils with low pH. This fertilizer is commonly applied to food crops such as rice, maize, and wheat.

3. SP-36 (Superphosphate 36)

SP-36 is a phosphate fertilizer containing approximately 36 % P_2O_5 . Phosphorus plays an important role in stimulating root growth, accelerating flowering, and enhancing fruit formation. This fertilizer also strengthens plant tolerance to environmental stress and shortens the time to harvest. SP-36 is produced as dark gray granules that are non-hygroscopic, making it relatively stable during storage and easy to apply. It is well suited for use as a basal fertilizer for food and horticultural crops because phosphorus is relatively immobile in soil.

4. Potassium Chloride (KCl)

Potassium chloride, also known as muriate of potash, contains potassium (approximately 60 % K_2O) and chloride (approximately 35 % Cl). Potassium plays a key role in improving crop quality in terms of size, taste, and storage life. It also strengthens plant stems, enhances resistance to diseases, and supports flower and fruit formation. Potassium chloride is available as red or white crystals that are readily soluble in water, allowing for rapid plant uptake. However, due to its chloride content, this fertilizer is less suitable for chloride-sensitive crops such as tobacco, potato, and shallot.



Figure 6.4 Types of Inorganic Fertilizers

C. General Recommendations for Balanced Fertilization

Recommendations for application rates and timing of balanced fertilization for various commodities, as presented in **Table 6.2**, are based on the official guidelines of the Ministry of Agriculture of the Republic of Indonesia (Directorate General of Food Crops, 2025).

Table 6.2 General Recommendations for Balanced Fertilization

Commodity	Rate (Kg ha ⁻¹)	Application Time & Fertilizer Allocation	
Rice	500 Organic Fertilizer 300 PHONSKA 200 Urea	Basal**	: 500 kg Organic Fertilizer + 150 kg PHONSKA + 50 kg Urea
		20 DAT	: 150 kg PHONSKA + 50 kg Urea
		35 DAT	: 100 kg Urea
Corn	500 Organic Fertilizer 300 PHONSKA 300 Urea	Basal	: 500 kg Organic Fertilizer + 150 kg PHONSKA + 75 kg Urea
		20 DAT	: 150 kg PHONSKA + 75 kg Urea
		35 DAT	: 150 kg Urea
Soybean / Peanut	500 Organic Fertilizer 250 PHONSKA	Basal	: 500 kg Organic Fertilizer + 125 kg PHONSKA
		30 DAT	: 125 kg PHONSKA
Cassava	500 Organic Fertilizer 300 PHONSKA 150 Urea	Basal	: 500 kg Organic Fertilizer + 150 kg PHONSKA + 25 kg Urea
		60 DAT	: 150 kg PHONSKA + 125 kg Urea
Sweet Potato	500 Organic Fertilizer 300 PHONSKA 100 Urea	Basal	: 500 kg Organic Fertilizer + 150 kg PHONSKA + 25 kg Urea
		30 DAT	: 150 kg PHONSKA + 75 kg Urea
Shallot	2.000 Organic Fertilizer 800 PHONSKA 400 ZA	Basal	: 2.000 kg Organic Fertilizer + 450 kg PHONSKA
		15 DAT	: 350 kg PHONSKA + 100 kg ZA
		30 DAT	: 300 kg ZA
Potato	2.000 Organic Fertilizer 1.000 PHONSKA 200 ZA	Basal	: 2.000 kg Organic Fertilizer + 500 kg PHONSKA + 100 kg ZA
		30 DAT	: 500 kg PHONSKA + 100 kg ZA
Cabbage	2.000 Organic Fertilizer 400 PHONSKA 300 ZA	Basal	: 2.000 kg Organic Fertilizer + 200 kg PHONSKA + 50 kg ZA
		15 DAT	: 200 kg PHONSKA + 50 kg ZA
		30 DAT	: 200 kg ZA
Tomato	2.000 Organic Fertilizer 800 PHONSKA 200 ZA	Basal	: 2.000 kg Organic Fertilizer + 400 kg PHONSKA
		15 DAT	: 400 kg PHONSKA
		30 DAT	: 200 kg ZA
Carrot	2.000 Organic Fertilizer 400 PHONSKA 300 ZA	Basal	: 2.000 kg Organic Fertilizer + 200 kg PHONSKA + 50 kg ZA
		15 DAT	: 200 kg PHONSKA + 50 kg ZA
		30 DAT	: 200 kg ZA
Bean / Long bean	2.000 Organic Fertilizer 450 PHONSKA	Basal	: 2.000 kg Organic Fertilizer + 150 kg PHONSKA
		15 DAT	: 150 kg PHONSKA
		30 DAT	: 150 kg PHONSKA

Commodity	Rate (Kg ha ⁻¹)	Application Time & Fertilizer Allocation	
Garlic	2.000 Organic Fertilizer 800 PHONSKA 400 ZA	Basal :	2.000 kg Organic Fertilizer + 400 kg PHONSKA
		20 DAT :	400 kg PHONSKA + 50 kg ZA
		40 DAT :	350 kg ZA
Chili Pepper	2.000 Organic Fertilizer 800 PHONSKA 200 ZA	Basal :	2.000 kg Organic Fertilizer + 400 kg PHONSKA
		20 DAT :	400 kg PHONSKA
		40 DAT :	200 kg ZA
Cucumber	2.000 Organic Fertilizer 400 PHONSKA	Basal :	2.000 kg Organic Fertilizer + 100 kg PHONSKA
		20 DAT :	150 kg PHONSKA
		35 DAT :	150 kg PHONSKA
Eggplant	2.000 Organic Fertilizer 700 PHONSKA 150 ZA	Basal :	2.000 kg Organic Fertilizer + 300 kg PHONSKA
		20 DAT :	300 kg PHONSKA
		40 DAT :	100 kg PHONSKA + 150 kg ZA
Broccoli / Cauliflower	2.000 Organic Fertilizer 800 PHONSKA	Basal :	2.000 kg Organic Fertilizer + 300 kg PHONSKA
		20 DAT :	250 kg PHONSKA
		35 DAT :	250 kg PHONSKA
Sugarcane	1.000 Organic Fertilizer 500 PHONSKA 450 ZA 80 KCL	Basal :	1.000 kg Organic Fertilizer + 250 kg PHONSKA + 225 kg ZA
		35 DAT :	250 kg PHONSKA + 225 kg ZA + 80 kg KCL
Watermelon / Melon	2.000 Organic Fertilizer 1.200 PHONSKA 250 ZK	Basal :	2.000 kg Organic Fertilizer + 400 kg PHONSKA + 125 kg ZK
		1-8 WAT :	800 kg PHONSKA + 125 kg ZK (drip/fertigation: 100–180 g /n10 L water for 40 plants every 3 days)
Orange*	3.000 Organic Fertilizer 1.600 PHONSKA	Early Rainy Season: 3.000 g Organic Fertilizer + 800 g PHONSKA Late Rainy Season 800 g PHONSKA	
Apple*	3.000 Organic Fertilizer 1.600 PHONSKA	After pruning: 3.000 g Organic Fertilizer + 800 g PHONSKA Fruit enlargement: 800 g PHONSKA	
Grape*	3.000 Organic Fertilizer 1.600 PHONSKA	After pruning: 3.000 g Organic Fertilizer + 900 g PHONSKA Fruit enlargement: 900 g PHONSKA	

Commodity	Rate (Kg ha ⁻¹)	Application Time & Fertilizer Allocation
Coffee*	3.000 Organic Fertilizer 1.100 PHONSKA 180 Kieserite	Early Rainy Season: 3.000 g Organic Fertilizer + 550 g PHONSKA + 90 g Kieserite Late Rainy Season: 550 g PHONSKA + 90 g Kieserite
Cocoa*	3.000 Organic Fertilizer 1.000 PHONSKA 180 Kieserite	Early Rainy Season: 3.000 g Organic Fertilizer + 500 g PHONSKA + 75 g Kieserite Late Rainy Season: 500 g PHONSKA + 75 g Kieserite
Pepper*	3.000 Organic Fertilizer 3.160 PHONSKA 300 KCL 275 Kieserite	Early Rainy Season: 3.000 g Organic Fertilizer + 1.500 g PHONSKA + 120 g KCL + 100 g Kieserite Topdressing I : 850 g PHONSKA + 90 g KCL + 85 g Kieserite Topdressing II : 540 g PHONSKA + 60 g KCL + 60 g Kieserite Topdressing III : 270 g PHONSKA + 30 g KCL + 30 g Kieserite <i>Notes : (interval 40–45 days)</i>
Rubber***	3 – 5 Organic Fertilizer 1 – 4 PHONSKA 1 – 2 Urea	Early Rainy Season: 3 – 5 kg Organic Fertilizer + 0,5 – 2 kg PHONSKA + 0,5 – 1 kg Urea Late Rainy Season: 0,5 – 2 kg PHONSKA + 0,5 – 1 kg Urea
Oil Palm***	5 – 10 Organic Fertilizer 5 – 7 PHONSKA 1 – 1,5 KCL 1 – 1,5 Kieserite	Early Rainy Season: 5 – 10 kg Organic Fertilizer + 2,5–3,5 kg PHONSKA + 0,5 – 0,75 kg KCL + 0,5 – 0,75 Kieserite Late Rainy Season: 2,5 – 3,5 kg PHONSKA + 0,5 – 0,75 kg KCL + 0,5 – 0,75 Kieserite

Notes:

* gr/tree, fertilizers are applied by incorporation in circular furrows around the trunk

** On sulfur-deficient soils, urea is replaced with 100 kg ammonium sulfate (ZA).

*** kg/tree, p fertilizers are applied by incorporation in circular furrows around the trunk.

DAT : Days After Planting

WAT : Weeks After Planting

Land Suitability Criteria

FOOD CROPS



Irrigated rice (*Oryza sativa*)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	24 - 29	22 - 24 29 - 32	18 - 22 32 - 35	< 18 > 35
Water Availability (wa)				-
Humidity (%)	33 - 90	30 - 33	< 30 > 90	-
Rooting Media (rc)				
Drainage	Somewhat Poorly Drained, Moderate	Poorly Drained, Well Drained	Very Poorly Drained Somewhat Excessively Drained	Excessively Drained
Texture	fine, Somewhat fine	Moderate	Somewhat coarse	Coarse
Coarse fragments (%)	< 3	3 - 15	15 - 35	> 35
Soil depth (cm)	> 50	40 - 50	25- 40	< 25
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 150	> 150
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	-
Base saturation (%)	>50	35 - 50	< 35	-
pH H ₂ O	5,5 - 7,0	4,5 - 5,5 7,0 - 8,0	< 4,5 > 8,0	-
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	-
Available Nutrients (nr)				
N total (%)	Moderate	Low	very low	-
P ₂ O ₅ (mg/100 g)	High	Moderate	Low-very low	-
K ₂ O (mg/100 g)	Moderate	Low	very low	-
Toxicity (xc)				
Salinity (dS/m)	< 2	2 - 4	4 - 6	> 6
Soodicity (xn)				
Alkalinity/ESP (%)	< 20	20 - 30	30 - 40	> 40
Sulfidic hazard(xs)				
Depth to sulfidic layer (cm)	> 100	75 - 100	40 - 75	< 40
Landslide hazard (eh)				
Slope (%)	< 3	3 - 5	5 - 8	> 8
Landslide hazard	-	Very slight	Slight	Moderate - Severe
Flooding/Inundation Hazard during planting period (fh)				
Depth (cm)	25	25 - 50	50 - 75	>75
- Duration (day)	without	< 7	7 - 14	>14
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Rainfed rice (*Oryza sativa*)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc) Average temperature (°C)	24 - 29	22 - 24 29 - 32	18 - 22 32 - 35	< 18 > 35
Water Availability (wa) Agroclimatic zone(Oldeman) Humidity (%)	B2,B3,C2 33 - 90	A1,A2,B1,C1 30 - 33	C3,C4,D1,D2,D3,D4,E1,E2 < 30 > 90	E3,E4 -
Rooting Media (rc) Drainage	Somewhat Poorly Drained , Moderate	Poorly Drained, Well Drained	Very Poorly Drained,Somewhat Excessively Drained	Excessively Drained
Texture	fine, Somewhat fine, Moderate	fine, Somewhat fine, Moderate	Somewhat coarse	Coarse
Coarse fragments (%)	< 3	3 - 15	15 - 35	> 35
Soil depth (cm)	> 50	40 - 50	25 - 40	< 25
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 150	>150
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr) Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	-
Base saturation (%)	> 50	35 - 50	< 35	-
pH H ₂ O	5,5 - 8,2	5,0 - 5,5 8,2 - 8,5	< 5,0 > 8,5	-
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	-
Available Nutrients (na)				
N total (%)	Moderate	Low	very low	-
P ₂ O ₅ (mg/100 g)	Highi	Moderate	Low-very low	-
K ₂ O (mg/100 g)	Moderate	Low	very low	-
Toxicity (xc) Salinity (dS/m)	< 2	2 - 4	4 - 6	> 6
Soodicity (xn) Alkalinity/ESP (%)	< 20	20 - 30	30 - 40	> 40
Sulfidic hazard(xs) Depth to sulfidic layer (cm)	> 100	75 - 100	40 - 75	< 40
Erosion hazard (eh) Slope (%)	< 3	3 - 8	8 - 15	> 15
Landslide hazard	-	Very slight	Slight	Moderate - Severe
Flood / waterlogging hazard during the growing season (fh)				
Depth (cm)	25	25 - 50	50 - 75	>75
- Duration (day)	without	< 7	7 - 14	>14
Land preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops(%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Upland rice (*Oryza sativa*)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	24 - 29	22 - 24 29 - 32	18 - 22 32 - 35	< 18 > 35
Water Availability (wa)				
Agroclimatic zone(Oldeman)	C2,C3,D2,D3	A2,B2,B3	A1,B1,C1,D1, E1,D4,E2,E3	E4
Humidity (%)	33 - 90	30 - 33	< 30 > 90	-
Rooting Media (rc)				
Drainage	Well Drained, Moderate	Somewhat Excessively Drained, Somewhat Poorly Drained	Poorly Drained, Very Poorly Drained	Excessively Drained
Texture	fine, Somewhat fine, Moderate	fine, Somewhat fine, Moderate	Somewhat coarse	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 50	40 - 50	25 - 40	< 25
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 150	>150
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	-
Base saturation (%)	> 35	20 - 35	< 20	-
pH H ₂ O	5,5 - 7,5	5,0 - 5,5 7,5 - 7,9	< 5,0 > 7,9	-
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	-
Available Nutrients (na)				
N total (%)	Moderate	Low	very low	-
P ₂ O ₅ (mg/100 g)	High	Moderate	Low - very low	-
K ₂ O (mg/100 g)	Moderate	Low	very low	-
Toxicity (xc)				
Salinity (dS/m)	< 2	2 - 4	4 - 6	> 6
Sodicity (xn)				
Alkalinity/ESP (%)	< 20	20 - 30	30 - 40	> 40
Sulfidic hazard(xs)				
Depth to sulfidic layer (cm)	-	-	-	-
Erosion hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion hazard		Very slight	Slight - Moderate	Severe - Very severe
Flood / waterlogging hazard during the growing season (fh)				
Depth (cm)	-	-	-	-
- Duration (day)	-	-	-	-
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Swamp rice (*Oryza sativa*)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	24 - 29	22 - 24 29 - 32	18 - 22 32 - 35	< 18 > 35
Water Availability (wa)				
Humidity (%)	33 - 90	30 - 33	< 30 > 90	-
Rooting Media (rc)				
Drainage	Poorly Drained, Somewhat Poorly Drained	Somewhat Poorly Drained, Somewhat Excessively Drained	Moderate, Well Drained	Excessive ly Drained
Texture	fine, Somewhat fine, Moderate	fine, Somewhat fine, Moderate	Somewhat coarse	Coarse
Coarse fragments (%)	< 3	3 - 15	15 - 35	> 35
Soil depth (cm)	> 50	40 - 50	25 - 40	< 25
Peat:				
Thickness (cm)	-	< 50	50 - 150	> 150
Decomposition level		Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	-
Base saturation (%)	> 35	20 - 35	< 20	-
pH H ₂ O	5,5 - 8,2	5,0 - 5,5 8,2 - 8,5	< 5,0 > 8,5	-
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	-
Available Nutrients (na)				
N total (%)	Moderate	Low	very low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	very low	-
K ₂ O (mg/100 g)	Moderate	Low	very low	-
Toxicity (xc)				
Salinity (dS/m)	< 2	2 - 4	4 - 6	> 6
Soodicity (xn)				
Alkalinity/ESP (%)	< 20	20 - 30	30 - 40	> 40
Sulfidic hazard(xs)				
Depth to sulfidic layer (cm)	> 100	75 - 100	40 - 75	< 40
Erosion hazard (eh)				
Slope (%)	-	-	-	-
Erosion hazard	-	-	-	-
Flood / waterlogging hazard during the growing season (fh)				
Depth (cm)	< 25	25 - 50	50 - 100	>100
- Duration (day)	-	-	-	-
Land Preparation (lp)				
Surface rock (%)	-	-	-	-
Rock outcrops (%)	-	-	-	-

Source : Ritung *et al.*, (2011)

Corn (*Zea mays*)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	20 - 26	26 - 30	16 - 20 30 - 32	< 16 > 32
Water Availability (wa)				
Curah hujan tahunan (mm)	900 - 1.200	1.200 - 1.600 500 - 900	> 1.600 300 - 500	< 300
Humidity (%)	> 42	36 - 42	30 - 36	< 30
Oxygen Availability (oa)				
Drainage	Well Drained, Moderate	Somewhat Excessively Drained, Somewhat Poorly Drained	Poorly Drained	Very Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	fine, Somewhat fine, Moderate	fine, Somewhat fine, Moderate	Somewhat coarse	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 60	40 - 60	25 - 40	< 25
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 150	>150
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	-
Base saturation (%)	> 50	35 - 50	< 35	-
pH H ₂ O	5,8 - 7,8	5,5 - 5,8 7,8 - 8,2	< 5,5 > 8,2	-
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	-
Available Nutrients (na)				
N total (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Highi	Moderate	Low -Very Low	-
K ₂ O (mg/100 g)	Highi	Moderate	Low -Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	4 - 8	> 8
Soodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfidic hazard(xs)				
Depth to sulfidic layer (cm)	> 100	75 - 100	40 - 75	< 40
Erosion hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion hazard		Very slight	Slight -Moderate	Severe - Very severe
Flooding/Inundation Hazard during planting period (fh)				
Depth (cm)	-	-	25	>25
- Duration (day)	-	-	<7	>7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Sorghum (*Shorgum bicolor*)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	25 - 27	27 - 30	30 - 35	> 35
		18 - 25	15 - 18	< 15
Elevation above sea level (m))	< 200	200 - 1.200	1.200 - 2.000	> 2.000
Water Availability (wa)				
Rain fall (mm)	400 - 900	300 - 400	130 - 500	< 150
		900 - 1.200	1.200 - 1.400	> 1.400
Length of dry period (months)	4 - 8	8 - 8,5	8,5 - 9,5	> 9,5
		2,5 - 4	1,5 - 2,5	< 1,5
Humidity (%)	< 75	75 - 85	> 85	-
Oxygen Availability (oa)				
Drainage	Well Drained, Somewhat Poorly Drained	Somewhat Excessively Drained,Moderate	Poorly Drained	Very Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	fine, Somewhat fine, Moderate	fine, Somewhat fine, Moderate	Somewhat coarse	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 60	40 - 60	25 - 40	< 25
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 150	>150
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	-
Base saturation (%)	> 50	35 - 50	< 35	
pH H ₂ O	5,5 - 8,2	5,3 - 5,5	< 5,3	
		8,2 - 8,5	> 8,5	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
N total (%)	Moderate	Low	very low	-
P ₂ O ₅ (mg/100 g)	Highi	Moderate	Low-very low	-
K ₂ O (mg/100 g)	Highi	Moderate	Low-very low	-
Toxicity (xc)				
Salinity (dS/m)	< 0,8	8 - 12	12 - 16	> 16
Soodicity (xn)				
Alkalinity/ESP (%)	< 20	20 - 28	28 - 35	> 35
Sulfidic hazard(xs)				
Depth to sulfidic layer (cm)	> 100	75 - 100	40 - 75	< 40
Erosion hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion hazard		Very slight	Slight - Moderate	Severe - Very severe
Flooding/Inundation Hazard during planting period (fh)				
Depth (cm)	-	-	25	>25
- Duration (day)	-	-	<7	>7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Wheat (*Triticum aestivum*)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	12 - 23	10 - 12 23 - 25	10 - 12 23 - 25	< 10 > 25
Elevation above sea level (m)	< 1.200	1.200 - 1.500	1.500 - 2.000	> 2.000
Water Availability (wa)				
Rain fall (mm)	350-1.250	250 - 350 1.250 - 1.500	200 - 250 1.500 - 1.750	< 200 > 1.750
Rainfall during the ripening period (mm)	30 - 100	10 - 30 100 - 200	< 10 > 200	-
Oxygen Availability (oa)				
Drainage	Well Drained, Somewhat Poorly Drained	Somewhat Excessively Drained, Moderate	Poorly Drained	Very Poorly Drained Excessively Drained
Rooting Media (rc)				
Texture	fine, Somewhat fine, Moderate	fine, Somewhat fine, Moderate	Somewhat coarse	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 50	20 - 50	10 - 20	< 10
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 150	>150
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	-
Base saturation (%)	> 50	35 - 50	< 35	
pH H ₂ O	6,0 - 8,2	5,6 - 6,0 8,2 - 8,5	< 5,6 > 8,5	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
N total (%)	Moderate	Low	very low	-
P ₂ O ₅ (mg/100 g)	Highi	Moderate	Low -very low	-
K ₂ O (mg/100 g)	Highi	Moderate	Low -very low	-
Toxicity (xc)				
Salinity (dS/m)	< 3	3 - 5	5 - 6	> 6
Soodicity (xn)				
Alkalinity/ESP (%)	< 20	20 - 35	35 - 45	> 45
Sulfidic hazard(xs)				
Depth to sulfidic layer (cm)	> 100	75 - 100	40 - 75	< 40
Erosion hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion hazard		Very slight	Slight - Moderate	Severe - Very severe
Flooding/Inundation Hazard during planting period (fh)				
Depth (cm)	-	-	25	>25
- Duration (day)	-	-	<7	>7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Cassava (*Manihot esculenta*)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	22 - 28	28 - 30	18 - 20 30 - 35	< 18 > 35
Water Availability (wa)				
Rain fall (mm)	1.000 - 2.000	600 - 1.000 2.000 - 3.000	500 - 600 3.000 - 4.000	< 500 > 4.000
Lama bulan kering (bulan)	3,5 - 5	5 - 6	6 - 7	> 7
Oxygen Availability (oa)				
Drainage	Well Drained, Moderate	Somewhat Excessively Drained, Somewhat Poorly Drained	Poorly Drained	Very Poorly Drained Excessively Drained
Rooting Media (rc)				
Texture	Somewhat fine, Moderate	fine, Somewhat coarse	Very Fine	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	<50	50-100	100-150	> 150
Decomposition level	Sapric	Sapric, Hemic	Sapric, Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	-
Base saturation (%)	20	< 20	< 20	-
pH H ₂ O	5,2 - 7,0	4,8 - 5,2 7,0 - 7,6	< 4,8 > 7,6	-
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	-
Available Nutrients (na)				
N total (%)	Moderate	Low	very low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	very low	-
K ₂ O (mg/100 g)	Moderate	Low	very low	-
Toxicity (xc)				
Salinity (dS/m)	< 2	2 - 3	3 - 4	> 4
Soodicity (xn)				
Alkalinity/ESP (%)	-	-	-	-
Sulfidic hazard(xs)				
Depth to sulfidic layer (cm)	> 100	75 - 100	40 - 75	< 40
Erosion hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion hazard		Very slight	Slight - Moderate	Severe - Very severe
Flooding/Inundation Hazard during planting period (fh)				
Depth (cm)	-	25	25 - 50	>50
- Duration (day)	-	<7	7 - 14	>14
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Sweet potato (*Ipomoea batatas*)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	22 – 25	25 – 30 20 – 22	30 – 35 18 – 20	> 35 < 18
Water Availability (wa)				
Rain fall (mm)	800 – 1.500	600 – 800 1.500 – 2.500	400 – 600 2.500 – 4.000	< 400 > 4.000
Number of dry months (months)	< 3	3 – 4	4–6	> 6
Humidity (%) at harvest	< 75	75 – 85	> 85	-
Oxygen Availability (oa)				
Drainage	Well Drained, Moderate	Somewhat Excessively Drained,agak Poorly Drained	Poorly Drained	Very Poorly Drained Excessively Drained
Rooting Media (rc)				
Texture	Somewhat fine,Moderate	fine, Somewhat coarse	Very Fine	Coarse
Coarse fragments (%)	< 15	15 – 35	35 – 55	-
Soil depth (cm)	> 75	50 – 75	25 – 50	< 25
Peat:				
Thickness (cm)	< 50	50 – 100	100 – 150	>150
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 – 16	< 5	-
Base saturation (%)	≥ 35	20 – 35	< 20	-
pH H ₂ O	5,2 – 8,2	4,8 – 5,2 8,2 – 8,4	< 4,8 > 8,4	-
Organic-C (%)	> 1,2	0,8 – 1,2	< 0,8	
Available Nutrients (na)				
N total (%)	Moderate	Low	very low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	very low	-
K ₂ O (mg/100 g)	Moderate	Low	very low	-
Toxicity (xc)				
Salinity (dS/m)	< 3	3 – 6	6 – 8	> 8
Soodicity (xn)				
Alkalinity/ESP (%)	< 15	15 – 20	20 – 25	> 25
Sulfidic hazard(xs)				
Depth to sulfidic layer (cm)	> 100	75 – 100	40 – 75	< 40
Erosion hazard (eh)				
Slope (%)	< 3	3 – 8	8 – 15	> 15
Erosion hazard		Very slight	Slight – Moderate	Severe – Very severe
Flooding/Inundation Hazard during planting period (fh)				
Depth (cm)	-	-	25	>25
- Duration (day)	-	-	<7	>7
Land Preparation (lp)				
Surface rock (%)	< 5	5 – 15	15 – 40	> 40
Rock outcrops (%)	< 5	5 – 15	15 – 25	> 25

Source : Ritung *et al.*, (2011)

Taro (*Colocasia esculenta* SCHOTT)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	25 - 32	> 32 22 - 25	20 - 22	< 20
Water Availability (wa)				
Rain fall (mm)				
first month	> 45	30 - 45	20 - 30	< 20
second month and third month	> 80	65 - 80	50 - 65	< 50
fourth month	> 20	≤ 20		
Oxygen Availability (oa)				
Drainage	Well Drained, Somewhat Poorly Drained	Somewhat Excessively Drained, Moderate	Poorly Drained	Very Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	Somewhat fine,Moderate	fine	Somewhat coarse	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 75	50 - 75	25 - 50	< 25
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 150	>150
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	-
Base saturation (%)	≥ 35	20 - 35	< 20	
pH H ₂ O	5,5 - 6,5	5,0 - 5,5 6,5 - 7,5	< 5,0 > 7,5	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	-
Available Nutrients (na)				
N total (%)	Moderate	Low	very low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	very low	-
K ₂ O (mg/100 g)	Moderate	Low	very low	-
Toxicity (xc)				
Salinity (dS/m)	< 2	2 - 3	3 - 4	> 4
Soodicity (xn)				
Alkalinity/ESP (%)	< 25	25 - 35	35 - 45	> 45
Sulfidic hazard(xs)				
Depth to sulfidic layer (cm)	> 100	75 - 100	40 - 75	< 40
Erosion hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion hazard		Very slight	Slight - Moderate	Severe - Very severe
Flooding/Inundation Hazard during planting period (fh)				
Depth (cm)	-	25	25 - 50	>50
- Duration (day)	-	<7	7 - 14	>14
Land Preparation (lp)				
Surface rock (%)	< 3	3 - 15	15 - 40	> 40
Rock outcrops (%)	< 2	2 - 10	10 - 25	> 25

Source : Ritung *et al.*, (2011)

Elephant foot yam (*Amorphophine ancophyllus*)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	26 - 30	18 - 32	18 - 32	> 32 < 18
Water Availability (wa)				
Rain fall (mm)	2.000 - 3.000	3.000 - 5.000 1.000 - 2.000	3.000 - 5.000 1.000 - 2.000	> 5.000 < 1.000
Oxygen Availability (oa)				
Drainage	Well Drained, Moderate	Somewhat Poorly Drained	Poorly Drained, Somewhat Excessively Drained	Very Poorly Drained Excessively Drained
Rooting Media (rc)				
Texture	Somewhat fine,Moderate	fine, Somewhat coarse	Very Fine	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 75	50 - 75	25 - 50	< 25
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 150	>150
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	-
Base saturation (%)	> 50	35 - 50	< 35	
pH H ₂ O	5,0 - 7,0	4,0 - 5,0 7,0 - 7,5	< 4,0 > 7,5	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
N total (%)	Moderate	Low	very low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	very low	-
K ₂ O (mg/100 g)	Moderate	Low	very low	-
Toxicity (xc)				
Salinity (dS/m)	< 5	5 - 8	8 - 10	> 10
Soodicity (xn)				
Alkalinity/ESP (%)	< 10	10 - 15	15 - 20	> 20
Sulfidic hazard(xs)				
Depth to sulfidic layer (cm)	> 100	75 - 100	40 - 75	< 40
Erosion hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion hazard		Very slight	Slight - Moderate	Severe - Very severe
Flooding/Inundation Hazard during planting period (fh)				
Depth (cm)	-	25	25 - 50	>50
- Duration (day)	-	<7	7 - 14	>14
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Yam

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	22 - 25	25 - 30 20 - 22	30 - 32 18 - 20	> 32 < 18
Water Availability (wa)				
Rain fall (mm)	1200 - 2000	2000 - 5000 800 - 1200	> 5000 600 - 800	< 600
Dry months	< 5	5 - 6	6 - 7	> 7
LGP	180 - 210	150 - 180	< 150	< 150
Oxygen Availability (oa)				
Drainage	Well Drained	Moderate	Somewhat Poorly Drained, Somewhat Excessively Drained	Poorly Drained, Very Poorly Drained Very Fine
Rooting Media (rc)				
Texture	Moderate, Somewhat fine	Coarse, Somewhat coarse Somewhat fine, fine	fine, Very Fine	-
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 75	50 - 75	25 - 50	< 25
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 150	>150
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	-
Base saturation (%)	-	-	-	-
pH H ₂ O	5,5 - 6,5	6,5 - 7,5 5,0 - 5,5	7,5 - 8,5 4,5 - 5,0	> 8,5 < 4,5
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	-
Available Nutrients (na)				
N total (%)	Moderate	Low	very low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	very low	-
K ₂ O (mg/100 g)	Moderate	Low	very low	-
Toxicity (xc)				
Salinity (dS/m)	< 2	2 - 3	3 - 5	> 5
Soodicity (xn)				
Alkalinity/ESP (%)				
Sulfidic hazard(xs)				
Depth to sulfidic layer (cm)	> 100	75 - 100	40 - 75	< 40
Erosion hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion hazard		Very slight	Slight - Moderate	Severe - Very severe
Flooding/Inundation Hazard during planting period (fh)				
Depth (cm)	-	25	25 - 50	>50
- Duration (day)	-	<7	7 - 14	>14
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Soybean (*Glycine max.*)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	23 - 25	20 - 23 25 - 28	18 - 20 28 - 32	< 18 > 32
Water Availability (wa)				
Rainfall during the growing period (mm)	350 - 1.100	250 - 350 1.100 - 1.600	180 - 250 1.600 - 1.900	< 180 > 1.900
Humidity (%)	24 - 80	20 - 24 80 - 85	< 20 > 85	-
Oxygen Availability (oa)				
Drainage	Well Drained, Moderate	Somewhat Excessively Drained, Somewhat Poorly Drained	Poorly Drained	Very Poorly Drained Excessively Drained
Rooting Media (rc)				
Texture	fine, Somewhat fine, Moderate	fine, Somewhat fine, Moderate	Somewhat coarse	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 50	30 - 50	20 - 30	< 20
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 150	> 150
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	-
Base saturation (%)	> 35	20 - 35	< 20	-
pH H ₂ O	5,5 - 7,5	5,0 - 5,5 7,5 - 7,8	< 5,0 > 7,8	-
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	-
Available Nutrients (na)				
N total (%)	Moderate	Low	very low	-
P ₂ O ₅ (mg/100 g)	High	Moderate	Low - very low	-
K ₂ O (mg/100 g)	High	Moderate	Low - very low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Sodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfidic hazard (xs)				
Depth to sulfidic layer (cm)	> 100	75 - 100	40 - 75	< 40
Erosion hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion hazard		Very slight	Slight - Moderate	Severe - Very severe
Flooding/Inundation Hazard during planting period (fh)				
Depth (cm)	-	-	25	> 25
- Duration (day)	-	-	< 7	≥ 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Peanut (*Arachis hypogea*)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	25 - 27	20 - 25 27 - 30	18 - 20 30 - 34	< 18 > 34
Water Availability (wa)				
Rainfall during the growing period (mm)	400 - 1.100	1.100 - 1.600 300 - 400	1.600 - 1.900 200 - 300	> 1.900 < 200
Humidity (%)	50 - 80	> 80 < 50	> 80 < 50	-
Oxygen Availability (oa)				
Drainage	Well Drained, Moderate	Somewhat Excessively Drained, Somewhat Poorly Drained	Poorly Drained	Very Poorly Drained Excessively Drained
Rooting Media (rc)				
Texture	Somewhat fine,Moderate	Somewhat coarse,Fine	Very Fine	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 75	50 - 75	25 - 50	< 25
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 150	>150
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	-
Base saturation (%)	> 35	20 - 35	< 20	-
pH H ₂ O	6,0 - 7,0	5,0 - 6,0 7,0 - 7,5	< 5,0 > 7,5	-
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	-
Available Nutrients (na)				
N total (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Highi	Moderate	Low -Very Low	-
K ₂ O (mg/100 g)	Highi	Moderate	Low -Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Soodicity (xn)				
Alkalinity/ESP (%)	< 10	10 - 15	15 - 20	> 20
Sulfidic hazard(xs)				
Depth to sulfidic layer (cm)	> 100	75 - 100	40 - 75	< 40
Erosion hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion hazard		Very slight	Slight - Moderate	Severe - Very severe
Flooding/Inundation Hazard during planting period (fh)				
Depth (cm)	-	-	25	>25
- Duration (day)	-	-	<7	≥7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Mung bean (*Phaseolus radiatus* LINN)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	12-24	24 - 27 10 - 12	27 - 30 8 - 10	> 30 < 8
Water Availability (wa)				
Rain fall (mm)	350 - 600	600 - 1.000 300 - 350	> 1.000 230 - 500	< 250
Humidity (%)	42 - 75	36 - 42 75 - 90	30 - 36 > 90	< 30
Oxygen Availability (oa)				
Drainage	Well Drained, Somewhat Poorly Drained	Somewhat Excessively Drained, Moderate	Poorly Drained	Very Poorly Drained Excessively Drained
Rooting Media (rc)				
Texture	fine, Somewhat fine, Moderate	fine, Somewhat fine, Moderate	Somewhat coarse	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 75	50 - 75	20 - 50	< 20
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 150	>150
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5-16	< 5	
Base saturation (%)	> 50	35 - 50	< 35	
pH H ₂ O	5,6 - 7,6	5,4 - 5,6 7,6 - 8,0	< 5,4 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
N total (%)	Moderate	Low	very low	-
P ₂ O ₅ (mg/100 g)	Highi	Moderate	Low -very low	-
K ₂ O (mg/100 g)	Highi	Moderate	Low -very low	-
Toxicity (xc)				
Salinity (dS/m)	< 1	1 - 1,5	1,5 - 2	> 2
Soodicity (xn)				
Alkalinity/ESP (%)	< 5	5 - 8	8 - 12	> 12
Sulfidic hazard(xs)				
Depth to sulfidic layer (cm)	> 100	75 - 100	40 - 75	< 40
Erosion hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion hazard		Very slight	Slight - Moderate	Severe - Very severe
Flooding/Inundation Hazard during planting period (fh)				
Depth (cm)	-	-	25	>25
- Duration (day)	-	-	<7	≥7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Cowpea (*Vigna unguiculata*)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	20 - 30	18 - 20 30 - 32	16 - 18 32 - 35	< 16 > 35
Water Availability (wa)				
Rainfall during the growing period (mm)	300 - 900	230 - 500 900 - 1.300	200 - 250 > 1.300	< 200
Humidity udara (%)masa panen	< 80	80 - 90	> 90	
Oxygen Availability (oa)				
Drainage	Well Drained, Somewhat Poorly Drained	Somewhat Excessively Drained, Moderate	Poorly Drained	sangat Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	Somewhat fine, fine, Moderate	Somewhat fine, fine, Moderate	Somewhat coarse	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 75	50 - 75	20 - 50	< 20
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 150	>150
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	6,0 - 7,8	5,5 - 6,0 7,8 - 8,0	< 5,5 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
N total (%)	Moderate	Low	very low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	very low	-
K ₂ O (mg/100 g)	Moderate	Low	very low	-
Toxicity (xc)				
Salinity (dS/m)	< 3	3 - 5	5 - 7	> 7
Soodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfidic hazard(xs)				
Depth to sulfidic layer (cm)	> 100	75 - 100	40 - 75	< 40
Erosion hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion hazard		Very slight	Slight - Moderate	Severe - Very severe
Flooding/Inundation Hazard during planting period (fh)				
Depth (cm)	-	-	25	>25
- Duration (day)	-	-	<7	≥7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Chickpea (*Cicer arietinum*)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	16 - 23	14 - 16 23 - 25	12 - 14 25 - 28	< 12 > 28
Water Availability (wa)				
Rainfall during the growing period (mm)	> 250	150 - 250	50 - 150	< 50
Oxygen Availability (oa)				
Drainage	Well Drained, Somewhat Poorly Drained	Somewhat Excessively Drained, Moderate	Poorly Drained	sangat Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	fine, Somewhat fine, Moderate	fine, Somewhat fine, Moderate	Somewhat coarse	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 75	50 - 75	30 - 50	< 30
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 150	>150
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 50	35 - 50	< 35	
pH H ₂ O	6,0 - 7,6	5,6 - 6,0 7,6 - 8,0	< 5,6 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
N total (%)	Moderate	Low	very low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	very low	-
K ₂ O (mg/100 g)	Moderate	Low	very low	-
Toxicity (xc)				
Salinity (dS/m)	< 2	2 - 3	3 - 6	> 6
Sodicity (xn)				
Alkalinity/ESP (%)	< 10	10 - 12	12 - 15	> 15
Sulfidic hazard(xs)				
Depth to sulfidic layer (cm)	> 100	75 - 100	40 - 75	< 40
Erosion hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion hazard		Very slight	Slight - Moderate	Severe - Very severe
Flooding/Inundation Hazard during planting period (fh)				
Depth (cm)	-	-	25	>25
- Duration (day)	-	-	<7	≥7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Land Suitability Criteria

HORTICULTURAL CROPS



Potato (*Solanum tuberosum*)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	16 - 18	14 - 16 18 - 20	12 - 14 20 - 23	< 12 > 23
Water Availability (wa)				
Rain fall (mm)				
first month	> 45	30 - 45	20 - 30	< 20
second month and third month	> 80	65 - 80	50 - 65	< 50
fourth month	> 20	≤ 20		
Oxygen Availability (oa)				
Drainage	Well drained, somewhat poorly drained	somewhat excessively drained, Moderate	poorly drained	Very poorly drained, excessively drained
Rooting Media (rc)				
Texture	somewhat fine, Moderate	somewhat coarse, fine	very fine	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 75	50 - 75	30 - 50	< 30
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 150	> 150
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	≥ 35	20 - 35	< 20	
pH H ₂ O	5,6 - 7,0	5,2 - 5,6 7,0 - 8,0	< 5,2 > 8,0	
Organic-C (%)	> 2	0,8 - 2,0	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Depth	Moderate	Low-Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 3	3 - 5	5 - 6	> 6
Sodicity (xn)				
Alkalinity/ESP (%)	< 25	25 - 35	35 - 45	> 45
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		very slight	Slight - Moderate	Severe - very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	-
- Duration (day)	-	-	-	-
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Carrot (*Daucus carota*)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	16 - 18	18 - 20 14 - 16	20 - 23 12-16	> 23 < 12
Water Availability (wa)				
Rainfall during the growing period (mm)	250 - 400	400 - 600 200 - 250	600 - 1.000 150 - 200	> 1.000 < 150
Humidity (%)	40 - 80	20 - 40 80 - 90	< 20 > 90	
Oxygen Availability (oa)				
Drainage	Well drained, somewhat poorly drained	Somewhat excessively drained, Moderate	poorly drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	somewhat coarse, somewhat fine, Moderate	fine	very fine	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 50	> 50	30 - 50	< 30
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 150	>150
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5-16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	6,0 - 7,0	5,7 - 6,0 7,0 - 7,6	< 5,7 > 7,6	
Organic-C (%)	> 2	0,8 - 2,0	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Depth	Moderate	Low-Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 1,5	1,5 - 4,5	4,5 - 7	> 7
Sodicity (xn)				
Alkalinity/ESP (%)	< 20	20 - 35	35 - 50	> 50
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 75	50 - 75	30 - 50	< 30
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	Slight- Moderate	Severe-very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	<7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Radish (*Raphanus sativus* LINN)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	16 - 18	18 - 20 14 - 16	20 - 23 12-16	> 23 < 12
Water Availability (wa)				
Rainfall during the growing period (mm)	250 - 400	400 - 600 200 - 250	600 - 1000 150 - 200	> 1000 < 150
Month kering	3-7	7-8	8-9	>9
LGP	120 - 140	90 - 120	< 90	
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat excessively drained, somewhat poorly drained	poorly drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	Coarse, agak coarse, Moderate, somewhat fine	fine	Very fine	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 50	>50	30 - 50	< 30
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 150	>150
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)				
Base saturation (%)				
pH H ₂ O	6,0 - 7,0	7,0 - 7,6 5,7 - 6,0	> 7,6 < 5,7	
Organic-C (%)	> 2	0,8 - 2,0	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	
K ₂ O (mg/100 g)	Moderate	Low	Very Low	
Toxicity (xc)				
Salinity (dS/m)	< 1,5	1,5 - 4,5	4,5 - 7	> 7
Soodicity (xn)				
Alkalinity/ESP (%)	< 20	20 - 35	35 - 50	> 50
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 75	50 - 75	30 - 50	< 30
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	Slight- Moderate	Severe-very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	<7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, ((2011))

Shallot (*Allium oscolonicum*)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	20 - 25	25 - 30 18 - 20	30 - 35 15 - 18	> 35 < 15
Water Availability (wa)				
Rain fall (mm)	350 - 600	600 - 800 300 - 350	800 -1.600 230 - 500	> 1.600 < 250
Oxygen Availability (oa)				
Drainage	Well drained, somewhat poorly drained	somewhat excessively drained, Moderate	poorly drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	somewhat fine, Moderate	fine	somewhat coarse,very fine	coarse
Coarse fragments (%)	> 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 50	30 - 50	20 - 30	< 20
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 150	>150
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5-16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	6,0 - 7,8	5,8 - 6,0 7,8 - 8,0	< 5,8 > 8,0	
Organic-C (%)	> 2	0,8 - 2,0	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	very Low	-
P ₂ O ₅ (mg/100 g)	Depth	Moderate	Low- very Low	-
K ₂ O (mg/100 g)	Moderate	Low	very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 2	2 - 3	3 - 5	> 5
Soodicity (xn)				
Alkalinity/ESP (%)	< 20	20 - 35	35 - 50	> 50
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 75	50 - 75	30 - 50	< 30
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	Slight-Moderate	Severe-very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	<7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Garlic (*Allium sativum* LINN)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	16 - 18	18 - 20 14 - 16	20 - 23 12-16	> 23 < 12
Water Availability (wa)				
Rain fall (mm)	350 - 600	600 - 800 300 - 350	800 -1.600 230 - 500	> 1.600 < 250
Oxygen Availability (oa)				
Drainage	Well drained, somewhat poorly drained	somewhat excessively drained, Moderate	poorly drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine, Moderate	fine, somewhat fine, Moderate	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 50	30 - 50	20 - 30	< 20
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 150	>150
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5-16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	6,0 - 7,8	5,8 - 6,0 7,8 - 8,0	< 5,8 > 8,0	
Organic-C (%)	> 2	0,8 - 2,0	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Depth	Moderate	Low-Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 2	2 - 3	3 - 5	> 5
Soodicity (xn)				
Alkalinity/ESP (%)	< 20	20 - 35	35 - 50	> 50
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	Slight-Moderate	Severe-very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	<7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Red chili (*Capsicum annuum*)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	21 - 27	27 - 28 16 - 21	28 - 30 14 - 16	> 30 < 14
Water Availability (wa)				
Rain fall (mm)	600 - 1.200	500 - 600 1.200 - 1.400	400 - 500 > 1.400	< 400
Oxygen Availability (oa)				
Drainage	Well drained, somewhat poorly drained	somewhat excessively drained, Moderate	poorly drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine, Moderate	fine, somewhat fine, Moderate	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 75	50 - 75	30 - 50	< 30
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 150	>150
Decomposition level	Sapric	Sapric, hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5-16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	6,0 - 7,6	5,5 - 6,0 7,6 - 8,0	< 5,5 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Depth	Moderate	Low-Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 3	3 - 5	5-7	> 7
Sodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 100	75 - 100	40 - 75	< 40
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	Slight-Moderate	Severe-very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	25	>25
- Duration (day)	-	-	<7	≥7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Bell Pepper (*Capsicum sp.*)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	18 - 26	26 - 27 16 - 18	27 - 28 14 - 16	> 28 < 14
Water Availability (wa)				
Rain fall (mm)	600 - 1.200	500 - 600 1.200 - 1.400	400 - 500 > 1.400	< 400
Oxygen Availability (oa)				
Drainage	Well drained, somewhat poorly drained	somewhat excessively drained, Moderate	poorly drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine, Moderate	fine, somewhat fine, Moderate	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 75	50 - 75	30 - 50	< 30
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 150	>150
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5-16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	6,0 - 7,6	5,5 - 6,0 7,6 - 8,0	< 5,5 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Depth	Moderate	Low-Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 3	3 - 5	5 - 7	> 7
Sodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 100	75 - 100	40 - 75	< 40
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	Slight-Moderate	Severe-very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	25	>25
- Duration (day)	-	-	<7	≥7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Cabbage (*Brassica oleracea* L.)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	13 - 24	24 - 30 13 - 10	30 - 35 5 - 10	> 35 < 5
Water Availability (wa)				
Rain fall (mm)	350 - 800	800 - 1.000 300 - 350	> 1.000 230 - 500	< 250
Humidity (%)	65 - 90	60 - 65 90 - 95	50 - 60 > 95	< 50
Oxygen Availability (oa)				
Drainage	Well drained, somewhat poorly drained	somewhat excessively drained, Moderate	poorly drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	somewhat fine, Moderate	fine, somewhat fine	somewhat coarse, very fine	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 50	-	25 - 50	< 25
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5-16	< 5	
Base saturation (%)	> 50	35 - 50	< 35	
pH H ₂ O	6,0 - 7,8	5,8 - 6,0 7,8 - 8,0	< 5,8 > 8,0	
Organic-C (%)	> 2	0,8 - 2,0	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4,5	4,5 - 7	7-10	> 10
Sodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 75	50 - 75	30 - 50	< 30
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	Slight-Moderate	Severe-very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	< 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Lettuce (*Lactuca sativa*)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	16 - 22	> 22 - 28 13 - < 16	> 28 - 35 4 - < 13	> 35 < 4
Water Availability (wa)				
Rain fall (mm)	250 - 400	> 400 - 600 200 - < 250	> 600 - 1000 150 - < 200	> 1000 < 150
Month kering	3-5	5-7	7-9	>9
LGP	150-240	120-150	90-120	<90
Oxygen Availability (oa)				
Drainage	Well drained, somewhat poorly drained	somewhat excessively drained, Moderate	poorly drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	somewhat fine, Moderate	fine	Somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	> 35 - 55	> 55
Soil depth (cm)	> 50	40 - 50	25 - < 40	< 25
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	>200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5-16	< 5	
Base saturation (%)				
pH H ₂ O	6,0 - 7,0	> 7,0 - 7,6 5,7 - < 6,0	> 7,6 < 5,7	
Organic-C (%)	> 2	0,8 - 2,0	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 1,5	1,5 - 4,5	> 4,5 - 7	> 7
Soodicity (xn)				
Alkalinity/ESP (%)	< 20	20 - 35	> 35 - 50	> 50
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 75	50 - 75	30 - < 50	< 30
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	Slight-Moderate	Severe-very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	<7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	> 15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	> 15 - 25	> 25

Source: Ritung *et al.*, (2011)

Petsai (*Brassica purpureum* SCHUM.)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	16 - 22	> 22 - 28 13 - < 16	> 28 - 35 4 - < 13	> 35 < 4
Water Availability (wa)				
Rain fall (mm)	250 - 400	> 400 - 600 200 - < 250	> 600 - 1000 150 - < 200	> 1000 < 150
Month kering				
LGP	150-240	120-150	90-120	<90
Oxygen Availability (oa)				
Drainage	Well drained, somewhat poorly drained	somewhat excessively drained, Moderate	poorly drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine, Moderate	fine, somewhat fine, Moderate	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	> 35 - 55	> 55
Soil depth (cm)	> 60	40 - 60	25 - < 40	< 25
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	>200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5-16	< 5	
Base saturation (%)				
pH H ₂ O	6,0 - 7,0	> 7,0 - 7,6 5,7 - < 6,0	> 7,6 < 5,7	
Organic-C (%)	> 2	0,8 - 2,0	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 1,5	1,5 - 4,5	> 4,5 - 7	> 7
Soodicity (xn)				
Alkalinity/ESP (%)	< 20	20 - 35	> 35 - 50	> 50
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 75	50 - 75	30 - < 50	< 30
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	Slight- Moderate	Severe-very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	<7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	> 15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	> 15 - 25	> 25

Source: Ritung *et al.*, (2011)

Caisim (*Brassica rugosa* FRAIN)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	16 - 22	> 22 - 28 13 - < 16	> 28 - 35 4 - < 13	> 35 < 4
Water Availability (wa)				
Rainfall during the growing period (mm)	250 - 400	> 400 - 600 200 - < 250	> 600 - 1.000 150 - < 200	> 1.000 < 150
Month kering	3 - 7	7 - 8	8 - 9	> 9
LGP (day)	150-240	120-150	90-120	<90
Oxygen Availability (oa)				
Drainage	Well drained, somewhat poorly drained	somewhat excessively drained, Moderate	poorly drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	somewhat fine, Moderate	fine	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	> 35 - 55	> 55
Soil depth (cm)	> 60	40 - 60	25 - < 40	< 25
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	>200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5-16	< 5	
Base saturation (%)				
pH H ₂ O	6,0 - 7,0	> 7,0 - 7,6 5,7 - < 6,0	> 7,6 < 5,7	
Organic-C (%)	> 2	0,8 - 2,0	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	
K ₂ O (mg/100 g)	Moderate	Low	Very Low	
Toxicity (xc)				
Salinity (dS/m)	< 1,5	1,5 - 4,5	> 4,5 - 7	> 7
Soodicity (xn)				
Alkalinity/ESP (%)	< 20	20 - 35	> 35 - 50	> 50
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 75	50 - 75	30 - < 50	< 30
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	Slight-Moderate	Severe-very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	<7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	> 15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	> 15 - 25	> 25

Source: Ritung *et al.*, (2011)

Spinach (*Amaranthus spe. div.*)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	12 - 24	> 24 - 27 10 - < 12	> 27 - 30 8 - < 10	> 30 < 8
Water Availability (wa)				
Rainfall during the growing period (mm)	350 - 600	> 600 - 1000 300 - < 350	> 1000 250 - < 300	< 250
Month kering	3 - 5	5 - 7	7 - 9	>9
LGP (day)				
Oxygen Availability (oa)				
Drainage	Well drained, somewhat poorly drained	somewhat excessively drained, Moderate	poorly drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	somewhat fine, Moderate	fine	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	> 35 - 55	> 55
Soil depth (cm)	> 75	50 - 75	20 - < 50	< 20
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	>200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5-16	< 5	
Base saturation (%)				
pH H ₂ O	5,6 - 7,6	> 7,6 - 8,0 5,4 - < 5,6	> 8,0 < 5,4	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	
K ₂ O (mg/100 g)	Moderate	Low	Very Low	
Toxicity (xc)				
Salinity (dS/m)	< 1	1 - 1,5	> 1,5 - 2	> 2
Soodicity (xn)				
Alkalinity/ESP (%)	< 5	5 - 8	> 8 - 12	> 12
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 75	50 - 75	30 - < 50	< 30
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	Slight- Moderate	Severe-very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	<7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	> 15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	> 15 - 25	> 25

Source: Ritung *et al.*, (2011)

Green Beans (*Phaseolus vulgaris*)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	12 – 24	24 – 27 10 – 12	27 – 30 8 – 12	> 30 < 8
Water Availability (wa)				
Rainfall during the growing period (mm)	350 – 600	600 – 1.000 300 – 350	> 1.000 230 – 500	< 250
Humidity (%)	42 – 75	36 – 42 75 – 90	30 – 36 > 90	< 30
Oxygen Availability (oa)				
Drainage	Well drained, somewhat poorly drained	somewhat excessively drained, Moderate	poorly drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine, Moderate	fine, somewhat fine, Moderate	somewhat coarse, very fine	coarse
Coarse fragments (%)	< 15	15 – 35	35 – 55	> 55
Soil depth (cm)	> 75	50 – 75	20 – 50	< 20
Peat:				
Thickness (cm)	< 50	50 – 100	100 – 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5–16	< 5	
Base saturation (%)	> 50	35 – 50	< 35	
pH H ₂ O	5,6 – 7,6	5,4 – 5,6 7,6 – 8,0	< 5,4 > 8,0	
Organic-C (%)	> 1,2	0,8 – 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 1	1 – 1,5	1,5 – 2	> 2
Sodicity (xn)				
Alkalinity/ESP (%)	< 5	5 – 8	8 – 12	> 12
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 75	50 – 75	30 – 50	< 30
Erosion Hazard (eh)				
Slope (%)	< 3	3 – 8	8 – 15	> 15
Erosion Hazard		Very slight	Slight- Moderate	Severe-very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	25	> 25
- Duration (day)	-	-	< 7	≥ 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 – 15	15 – 40	> 40
Rock outcrops (%)	< 5	5 – 15	15 – 25	> 25

Source: Ritung *et al.*, (2011)

Long Beans (*Vigna sinensis* ENDL)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	12 - 24	24 - 27 10 - 12	27 - 30 8 - 10	> 30 < 8
Water Availability (wa)				
Rainfall during the growing period (mm)	350 - 600	600 - 1.000 300 - 350	> 1.000 230 - 500	< 250
Humidity (%)	42 - 75	36 - 42 75 - 90	30 - 36 > 90	< 30
Oxygen Availability (oa)				
Drainage	Well drained, somewhat poorly drained	somewhat excessively drained, Moderate	poorly drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine, Moderate	fine, somewhat fine, Moderate	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 75	50 - 75	20 - 50	< 20
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5-16	< 5	
Base saturation (%)	> 50	35 - 50	< 35	
pH H ₂ O	5,6 - 7,6	5,4 - 5,6 7,6 - 8,0	< 5,4 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 1	1 - 1,5	1,5 - 2	> 2
Sodicity (xn)				
Alkalinity/ESP (%)	< 5	5 - 8	8 - 12	> 12
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 100	75 - 100	40 - 75	< 40
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	Slight-Moderate	Severe-very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	25	> 25
- Duration (day)	-	-	< 7	≥ 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Snow pea (*Pisum sativum*)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	14 - 20	10 - 14 20 - 23	8 - 10 23 - 25	< 8 > 25
Water Availability (wa)				
Rainfall during the growing period (mm)	350 - 600	300 - 350 600 - 800	200 - 300 800 - 1.000	< 200 > 1.000
Oxygen Availability (oa)				
Drainage	Well drained, somewhat poorly drained	somewhat excessively drained, Moderate	poorly drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	somewhat fine, fine, Moderate	somewhat fine, fine, Moderate	Somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 60	50 - 60	20 - 50	< 20
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	≤ 16		
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	6,0 - 7,5	5,8 - 6,0 7,5 - 8,0	< 5,8 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 2,5	2,5 - 3,5	3,5 - 6	> 6
Soodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 100	75 - 100	40 - 75	< 40
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	Slight-Moderate	Severe-very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	25	> 25
- Duration (day)	-	-	< 7	≥ 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Cucumber (*Cucumis sativus* LINN)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	22 - 30	30 - 32 20 - 22	32 - 35 18 - 20	> 35 < 18
Water Availability (wa)				
Rain fall (mm)	400 - 700	700 - 1.000 300 - 400	> 1.000 230 - 500	< 250
Air Humidity (%)	24 - 80	20 - 24 80 - 90	< 20 > 90	
Oxygen Availability (oa)				
Drainage	Well drained, somewhat poorly drained	somewhat excessively drained, Moderate	poorly drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine, Moderate	fine, somewhat fine, Moderate	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 50	> 50	25 - 50	< 25
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,8 - 7,6	5,5 - 5,8 7,6 - 8,0	< 5,5 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Soodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 75	50 - 75	30 - 50	< 30
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	Slight- Moderate	Severe-very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	25	> 25
- Duration (day)	-	-	< 7	≥ 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Eggplant (*Solanum Melongena* LINN)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	18 - 26	26 - 30 16 - 18	30 - 35 13 - 16	> 35 < 13
Water Availability (wa)				
Rainfall during the growing period (mm)	400 - 700	700 - 800 300 - 400	> 800 230 - 500	< 250
Air Humidity (%)	24 - 80	80 - 90 20 - 24	> 90 < 24	
Oxygen Availability (oa)				
Drainage	Well drained, somewhat poorly drained	somewhat excessively drained, Moderate	poorly drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine, Moderate	fine, somewhat fine, Moderate	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 50	> 50	25 - 50	< 25
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	6,0 - 7,5	5,5 - 6,0 7,5 - 8,0	< 5,5 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 5	5 - 8	8 - 10	> 10
Soodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 25	25 - 35	> 35
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 100	75 - 100	40 - 75	< 40
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	Slight-Moderate	Severe-very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	25	> 25
- Duration (day)	-	-	< 7	≥ 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Bitter Melon (*Momordica charantia* LINN)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	18 - 25	25 - 30 15 - 18	30 - 35 10 - 15	> 35 < 10
Water Availability (wa)				
Rain fall (mm)	1.000 - 2.500	500 - 1.000 2.500 - 4.000	250 - 500 4.000 - 6.000	< 250 > 6.000
Humidity (%)	> 42	36 - 42	30 - 36	< 30
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine, Moderate	fine, somewhat fine, Moderate	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 50	> 50	25 - 50	< 25
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,5 - 7,8	5,0 - 5,5 7,8 - 8,0	< 5,0 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Soodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 75	50 - 75	30 - 50	< 30
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	Slight- Moderate	Severe-very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	< 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Broccoli (*Brassica oleracea var italica*)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	13 - 24	24 - 30 13 - 10	30 - 35 5 - 10	> 35 < 5
Water Availability (wa)				
Rain fall (mm)	350 - 800	800 - 1.000 300 - 350	> 1.000 230 - 500	< 250
Humidity (%)	65 - 90	60 - 65 90 - 95	50 - 60 > 95	< 50
Oxygen Availability (oa)				
Drainage	Well drained, somewhat poorly drained	somewhat excessively drained, Moderate	poorly drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine, Moderate	fine, somewhat fine, Moderate	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 50	> 50	25 - 50	< 25
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	>200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 50	35 - 50	< 35	
pH H ₂ O	6,0 - 7,8	5,8 - 6,0 7,8 - 8,0	< 5,8 > 8,0	
Organic-C (%)	> 2,0	0,8 - 2,0	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4,5	4,5 - 7	7 - 10	> 10
Sodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 75	50 - 75	30 - 50	< 30
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	Slight- Moderate	Severe-very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	<7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Asparagus (*Asparagus officinalis* LINN)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	12 - 24	24 - 27 10 - 12	27 - 30 8-10	> 30 < 8
Water Availability (wa)				
Rain fall (mm)	350 - 600	600 - 1.000 300 - 350	> 1.000 230 - 500	< 250
Humidity (%)	42 - 75	36 - 42 75 - 90	30 - 36 > 90	< 30
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine, Moderate	fine, somewhat fine, Moderate	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 75	50 - 75	20 - 50	< 20
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	>200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 50	35 - 50	< 35	
pH H ₂ O	5,6 - 7,6	5,4 - 5,6 7,6 - 8,0	< 5,4 > 8,0	
Organic-C (%)	> 2,0	0,8 - 2,0	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 1	1 - 1,5	1,5 - 2	> 2
Sodicity (xn)				
Alkalinity/ESP (%)	< 5	5 - 8	8 - 12	> 12
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 75	50 - 75	30 - 50	< 30
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	Slight- Moderate	Severe-very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	25	>25
- Duration (day)	-	-	<7	>7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Beet (*Beta vulgaris* L.)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	16 - 22	22 - 28 13 - 16	28 - 35 4 - 13	> 35 < 4
Water Availability (wa)				
Rainfall during the growing period (mm)	250 - 400	400 - 600 200 - 250	600 - 1.000 150 - 200	> 1.000 < 150
Humidity (%)	40 - 80	20 - 40 80 - 90	< 20 > 90	
Oxygen Availability (oa)				
Drainage	Well drained, somewhat poorly drained	somewhat excessively drained, Moderate	poorly drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine, Moderate	fine, somewhat fine, Moderate	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 50	> 50	30 - 50	< 30
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	6,0 - 7,0	5,7 - 6,0 7,0 - 7,6	< 5,7 > 7,6	
Organic-C (%)	> 2,0	0,8 - 2,0	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 1,5	1,5 - 4,5	4,5 - 7	> 7
Soodicity (xn)				
Alkalinity/ESP (%)	< 20	20 - 35	35 - 50	> 50
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 75	50 - 75	30 - 50	< 30
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	Slight-Moderate	Severe-very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	< 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Kailan (*Brassica oleracea* var. *acephala*)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	16 - 22	22 - 28 13 - 16	28 - 35 4 - 13	> 35 < 4
Water Availability (wa)				
Rainfall during the growing period (mm)	250 - 400	400 - 600 200 - 250	600 - 1.000 150 - 200	> 1.000 < 150
Humidity (%)	40 - 80	20 - 40 80 - 90	< 20 > 90	
Oxygen Availability (oa)				
Drainage	Well drained, somewhat poorly drained	somewhat excessively drained, Moderate	poorly drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine, Moderate	fine, somewhat fine, Moderate	Somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 60	40 - 60	25 - 40	< 25
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	6,0 - 7,0	5,7 - 6,0 7,0 - 7,6	< 5,7 > 7,6	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 1,5	1,5 - 4,5	4,5 - 7	> 7
Sodicity (xn)				
Alkalinity/ESP (%)	< 20	20 - 35	35 - 50	> 50
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 75	50 - 75	30 - 50	< 30
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	Slight-Moderate	Severe-very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	< 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Tomato vegetable (*Solanum lycopersicon esculentum* MILL.)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	18 – 26	26 – 30 16 – 18	30 – 35 13 – 16	> 35 < 13
Water Availability (wa)				
Rainfall during the growing period (mm)	400 – 700	700 – 800 300 – 400	> 800 200 – 300	< 200
Air Humidity (%)	24 – 80	80 – 90 20 – 24	> 90 < 24	
Oxygen Availability (oa)				
Drainage	Well drained, somewhat poorly drained	somewhat excessively drained, Moderate	poorly drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine, Moderate	fine, somewhat fine, Moderate	somewhat coarse, very fine	coarse
Coarse fragments (%)	< 15	15 – 35	35 – 55	> 55
Soil depth (cm)	> 50	> 50	30 – 50	< 30
Peat:				
Thickness (cm)	< 50	50 – 100	100 – 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 – 16	< 5	
Base saturation (%)	> 35	20 – 35	< 20	
pH H ₂ O	6,0 – 7,5	5,5 – 6,0 7,5 – 8,0	< 5,5 > 8,0	
Organic-C (%)	> 1,2	0,8 – 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 5	5 – 8	8 – 10	> 10
Sodicity (xn)				
Alkalinity/ESP (%)	< 15	15 – 25	25 – 35	> 35
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 100	75 – 100	40 – 75	< 40
Erosion Hazard (eh)				
Slope (%)	< 3	3 – 8	8 – 15	> 15
Erosion Hazard		Very slight	Slight-Moderate	Severe-very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	25	> 25
- Duration (day)	-	-	< 7	> 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 – 15	15 – 40	> 40
Rock outcrops (%)	< 5	5 – 15	15 – 25	> 25

Source: Ritung *et al.*, (2011)

Bitter bean (*Parkia speciosa* HASSK)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	18 - 25	25 - 30 15 - 18	30 - 35 10 - 15	> 35 < 10
Water Availability (wa)				
Rain fall (mm)	1.000 - 2.000	500 - 1.000 2.000 - 3.000	250 - 500 3.000 - 4.000	< 250 > 4.000
Humidity (%)	> 42	36 - 42	30 - 36	< 30
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine	Moderate	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,5 - 7,8	5,0 - 5,5 7,8 - 8,0	< 5,0 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Sodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 175	125 - 175	75 - 125	< 75
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	very slight	Slight - Moderate	Severe	very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	< 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Banana (*Musa acuminata* COLLA)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	25 - 27	27 - 30 22 - 25	30 - 35 22 - 25	> 35 < 18
Depth of site(m)	< 1.200	1.200 - 1.500	1.500 - 2.000	> 2.000
Water Availability (wa)				
Rain fall (mm)	1.500 - 2.500	1.250 - 1.500 2.500 - 3.000	1.000 - 1.250 3.000 - 4.000	< 1.000 > 4.000
Durationnya of dry period (month)	0 - 3	3 - 4	4 - 6	> 6
Humidity (%)	> 60	50 - 60	30 - 50	< 30
Oxygen Availability (oa)				
Drainage	Well drained, somewhat poorly drained	somewhat excessively drained, Moderate	poorly drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine, Moderate	fine, somewhat fine, Moderate	somewhat coarse, very fine	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 75	> 75	50 - 75	< 50
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 50	35 - 50	< 35	
pH H ₂ O	5,6 - 7,5	5,2 - 5,6 7,5 - 8,0	< 5,2 > 8,2	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 2	2 - 4	4 - 6	> 6
Sodicity (xn)				
Alkalinity/ESP (%)	< 4	4 - 8	8 - 12	> 12
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 100	75 - 100	40 - 75	< 40
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	very slight	Slight - Moderate	Severe	very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	25	25-50	50-75	> 75
- Duration (day)	< 7	7-10	10-14	> 14
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Papaya (*Carica papaya* L.)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	25 - 28	28 - 34 20 - 25	34 - 38 15 - 20	> 38 ,15
Water Availability (wa)				
Rain fall (mm)	1.000 - 1.500	800 - 1.000 1.500 - 2.000	600 - 800 > 2.000	< 600
Air Humidity (%)	24 - 80	20 - 24 80 - 90	< 20 > 90	
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	Moderate, somewhat fine, fine	somewhat coarse	very fine	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 75	> 75	50 - 75	< 50
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	>200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	6,0 - 6,6	5,5 - 6,0 > 6,6	< 5,5	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 2	2 - 3	3 - 4	> 4
Soodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 125	100 - 125	60 - 100	< 60
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 30	> 30
Erosion Hazard	very slight	Slight - Moderate	Severe	very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	25	>25
- Duration (day)	-	-	<7	≥7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Fruit Tomato (*Solanum lycopersicon*)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	18 - 26	26 - 30 16 - 18	30 - 35 13 - 16	> 35 < 13
Water Availability (wa)				
Rainfall during the growing period (mm)	400 - 700	700 - 800 300 - 400	> 800 200 - 300	< 200
Kelebaban udara (%)	24 - 80	80 - 90 20 - 24	> 90 < 24	
Oxygen Availability (oa)				
Drainage	Well drained, somewhat poorly drained	somewhat excessively drained, Moderate	poorly drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine, Moderate	fine, somewhat fine, Moderate	somewhat coarse, very fine	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 50	> 50	30 - 50	< 30
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	6,0 - 7,5	5,5 - 6,0 7,5 - 8,0	< 5,5 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Depth	Moderate	Low-Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 5	5 - 8	8 - 10	> 10
Sodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 25	25 - 35	> 35
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 100	75 - 100	40 - 75	< 40
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	Slight-Moderate	Severe-very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	25	> 25
- Duration (day)	-	-	< 7	≥ 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Orange (*Citrus aurantium*)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	19 - 33	33 - 36 16 - 19	36 - 39 13 - 16	> 39 < 13
Water Availability (wa)				
Rain fall (mm)	1.200 - 3.000	1.000 - 1.200 3.000 - 3.500	800 - 1.000 3.000 - 4.000	< 800 > 4.000
Duration of dry period (month)	2,5 - 4	4 - 5	5 - 6	> 6
Humidity (%)	50 - 90	<50 >90		
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessivel y drained
Rooting Media (rc)				
Texture	Moderate, somewhat fine	somewhat coarse, fine	very fine	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	>200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	≥ 20	< 20	< 20	
pH H ₂ O	5,5 - 7,6	5,2 - 5,5 7,6 - 8,0	< 5,2 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Depth	Moderate	Low-Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 3	3 - 4	4 - 6	> 6
Sodicity (xn)				
Alkalinity/ESP (%)	< 8	8 - 12	12 - 15	> 15
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 125	100 - 125	60 - 100	< 60
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 30	> 30
Erosion Hazard	very slight	Slight -Moderat	Severe	very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	<7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Apple (*Malus silvestris* MILL)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	16 - 20	20 - 25 13 - 16	25 - 27 10 - 13	> 27 < 10
Water Availability (wa)				
Rain fall (mm)	2.200-2.500	1.800 - 2.200 2.500 - 3.000	1.600 - 1.800 3.000 - 3.200	< 1.600 > 3.200
Humidity (%)	> 42	36 - 42	25 - 36	< 25
Oxygen Availability (oa)				
Drainage	Well drained, Moderately well drained	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	somewhat fine, fine	Moderate	somewhat coarse,very fine	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	>200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,5 - 7,8	5,0 - 5,5 7,8 - 8,0	< 5,0 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Depth	Moderate	Low- Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Sodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 30	> 30
Erosion Hazard	very slight	Slight - Moderate	Severe	very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	<7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Avocado (*Persea americana*)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	18 - 26	26 - 30 15 - 18	> 30 10 - 15	< 10
Water Availability (wa)				
Rain fall (mm)	1.200 - 2.000	1.000 - 1.200 > 2.000	750 - 1.000	< 750
Duration dry month (month)	1-4	< 1 4-5	5 - 6	> 6
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine	Moderate	very fine, somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	>200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,0 - 6,5	4,6 - 5,0 6,5 - 7,5	< 4,6 > 7,5	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 3	3 - 4	4 - 5	> 5
Sodicity (xn)				
Alkalinity/ESP (%)	< 10	10 - 15	15 - 20	> 20
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	very slight	Slight - Moderate	Severe	very severe
Flooding/Inundation Hazard				
during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	<7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Mango (*Mangifera indica*)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	22 - 28	28 - 34 18 - 22	34 - 40 15 - 18	> 40 < 15
Water Availability (wa)				
Rain fall (mm)	1.250 - 1.750	1.750 - 2.000 1.000 - 1.250	2.000 - 2.500 750 - 1.000	> 2.500 < 750
Humidity (%)	> 42	36 - 42	30 - 36	< 30
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	somewhat fine, fine	Moderate	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,5 - 7,8	5,0 - 5,5 7,8 - 8,0	< 5,0 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Sodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 125	100 - 125	60 - 100	< 60
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 30	> 30
Erosion Hazard	very slight	Slight - Moderate	Severe	very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	< 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Rambutan (*Nephelium lappaceun* LINN)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	25 - 28	28 - 32 22 - 25	32 - 35 20 - 22	> 35 < 20
Water Availability (wa)				
Rain fall (mm)	2.000 - 3.000	1.750 - 2.000 3.000 - 3.500	1.250 - 1.750 3.500 - 4.000	< 1.250 > 4.000
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine	Moderate	somewhat coarse, very fine	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,0 - 6,0	4,5 - 5,0 6,0 - 7,5	< 4,5 > 7,5	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Sodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 125	100 - 125	60 - 100	< 60
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 30	> 30
Erosion Hazard	very slight	Slight - Moderate	Severe	very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	25	25 - 50	> 50
- Duration (day)	-	< 7	7 - 14	> 14
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Guava (*Psidium guajava* LINN)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	22 - 28	28 - 34 18 - 22	34 - 40 15 - 18	> 40 < 15
Water Availability (wa)				
Rain fall (mm)	1.000 - 2.000	500 - 1.000 2.000 - 3.000	250 - 500 3.000 - 4.000	< 250 > 4.000
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine	Moderate	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	>200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,0 - 6,0	4,5 - 5,0 6,0 - 7,5	< 4,5 > 7,5	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Soodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 100	75 - 100	40 - 75	< 40
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 30	> 30
Erosion Hazard	very slight	Slight - Moderate	Severe	very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	25	25 - 50	>50
- Duration (day)	-	<7	7 - 14	>14
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Water Apple (*Psidium guajava*)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	22 - 28	28 - 34 18 - 22	34 - 40 15 - 18	> 40 < 15
Water Availability (wa)				
Rain fall (mm)	1.000 - 2.000	500 - 1.000 2.000 - 3.000	250 - 500 3.000 - 4.000	< 250 > 4.000
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine	Moderate	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,0 - 6,0	4,5 - 5,0 6,0 - 7,5	< 4,5 > 7,5	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Sodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 125	100 - 125	60 - 100	< 60
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 30	> 30
Erosion Hazard	very slight	Slight - Moderate	Severe	very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	25	25 - 50	> 50
- Duration (day)	-	< 7	7 - 14	> 14
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Durian (*Durio zibethinus* MURR)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	25 - 28	28 - 32 22 - 25	32 - 35 20 - 22	> 35 < 20
Water Availability (wa)				
Rain fall (mm)	2.000 - 3.000	1.750 - 2.000 3.000 - 3.500	1.250 - 1.750 3.000 - 4.000	< 1.250 > 4.000
Humidity (%)	> 42	36 - 42	30 - 36	< 30
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	somewhat fine, fine	Moderate	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,5 - 7,8	5,0 - 5,5 7,8 - 8,0	< 5,0 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Soodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 125	100 - 125	60 - 100	< 60
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	very slight	Slight - Moderate	Severe	very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	< 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Starfruit (*Averrhoa bilimbi*)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	22 - 25	25 - 30 22 - 18	30 - 35 10 - 15	> 35 < 10
Water Availability (wa)				
Rain fall (mm)	1.000 - 2.000	500 - 1.000 2.000 - 3.000	250 - 500 3.000 - 6.000	< 250 > 6.000
Humidity (%)	> 42	36 - 42	30 - 36	< 30
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	somewhat fine, fine	Moderate	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	>200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,5 - 7,8	5,0 - 5,5 7,8 - 8,0	< 5,0 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Toxicity (xc)				
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Sodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 125	100 - 125	60 - 100	< 60
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 30	> 30
Erosion Hazard	very slight	Slight - Moderate	Severe	very severe
Flooding/Inundation Hazard				
during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	<7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Watermelon (*Colocynthis citrullus*)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	22 - 30	30 - 32 20 - 22	32 - 35 18 - 20	> 35 < 18
Water Availability (wa)				
Rain fall (mm)	400 - 700	700 - 1.000 300 - 400	> 1.000 300 - 400	< 200
Air Humidity (%)	24 - 80	20 - 24 80 - 90	< 20 > 90	
Oxygen Availability (oa)				
Drainage	Well drained, somewhat poorly drained	somewhat excessively drained, Moderate	poorly drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	Moderate, somewhat fine	fine, veryfine	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 50	> 50	30 - 50	< 30
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 150	>150
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,8 - 7,6	5,5 - 5,8 7,6 - 8,0	< 5,5 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Depth	Moderate	Low- Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Soodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 100	75 - 100	40 - 75	< 40
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	Slight- Moderate	Severe-very severe
Flooding/Inundation Hazard				
during planting period (fh)				
- Depth (cm)	-	-	25	> 25
- Duration (day)	-	-	<7	≥ 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Muskmelon (*Passiflora quadrangularia* LINN)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	22 - 30	30 - 32 20 - 22	32 - 35 18 - 20	> 35 < 18
Water Availability (wa)				
Rain fall (mm)	400 - 700	700 - 1.000 300 - 400	> 1.000 200 - 300	< 200
Air Humidity (%)	24 - 80	20 - 24 80 - 90	< 20 > 90	
Oxygen Availability (oa)				
Drainage	Well drained, somewhat poorly drained	somewhat excessively drained, Moderate	poorly drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	Moderate, somewhat fine	fine, veryfine	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 50	> 50	30 - 50	< 30
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 150	>150
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,8 - 7,6	5,5 - 5,8 7,6 - 8,0	< 5,5 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Depth	Moderate	Low- Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Sodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 100	75 - 100	40 - 75	< 40
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	Slight- Moderate	Severe-very severe
Flooding/Inundation Hazard				
during planting period (fh)				
- Depth (cm)	-	-	25	> 25
- Duration (day)	-	-	<7	≥ 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Melon (*Citrulus vulgaris* SHRAD)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	22 - 30	30 - 32 20 - 22	32 - 35 18 - 20	> 35 < 18
Water Availability (wa)				
Rain fall (mm)	400 - 700	700 - 1.000 300 - 400	> 1.000 200 - 300	< 200
Air Humidity (%)	24 - 80	20 - 24 80 - 90	< 20 > 90	
Oxygen Availability (oa)				
Drainage	Well drained, somewhat poorly drained	somewhat excessively drained, Moderate	poorly drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	Moderate, somewhat fine	fine, Very fine	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 50	> 50	30 - 50	< 30
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 150	> 150
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,8 - 7,6	5,5 - 5,8 7,6 - 8,0	< 5,5 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Depth	Moderate	Low - Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Soodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 100	75 - 100	40 - 75	< 40
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	Slight- Moderate	Severe-very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	25	> 25
- Duration (day)	-	-	< 7	≥ 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Lansium (*Lansium domesticum* CORR)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	25 - 28	28 - 32 22 - 25	32 - 35 20 - 22	> 35 < 20
Water Availability (wa)				
Rain fall (mm)	2.000 - 3.000	1.750 - 2.000 3.000 - 3.500	1.250 - 1.750 3.000 - 4.000	< 1.250 > 4.000
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine	Moderate	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,0 - 6,0	4,5 - 5,0 6,0 - 7,5	< 4,5 > 7,5	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Soodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 125	100 - 125	60 - 100	< 60
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	very slight	Slight - Moderate	Severe	very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	25	25 - 50	> 50
- Duration (day)	-	< 7	7 - 14	> 14
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Cempedak (*Artocarpus champeden* SPRENG)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	22 - 28	28 - 34 18 - 22	34 - 40 15 - 18	> 40 < 15
Water Availability (wa)				
Rain fall (mm)	1.000 - 2.000	500 - 1.000 2.000 - 3.000	250 - 500 3.000 - 6.000	< 250 > 6.000
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine	Moderate	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,0 - 6,0	4,5 - 5,0 6,0 - 7,5	< 4,5 > 7,5	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Soodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 125	100 - 125	60 - 100	< 60
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	very slight	Slight - Moderate	Severe	very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	25	25 - 50	> 50
- Duration (day)	-	< 7	7 - 14	> 14
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Jackfruit (*Artocarpus integra* MERR)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	22 - 28	28 - 34 18 - 22	34 - 40 15 - 18	> 40 < 15
Water Availability (wa)				
Rain fall (mm)	1.500 - 2.000	2.000 - 3.000 1.000 - 1.500	3.000 - 4.000 750 - 1.000	> 4.000 < 750
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine	Moderate	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,0 - 6,0	4,5 - 5,0 6,0 - 7,5	< 4,5 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Soodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 125	100 - 125	60 - 100	< 60
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	very slight	Slight - Moderate	Severe	very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	25	25 - 50	> 50
- Duration (day)	-	< 7	7 - 14	> 14
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Soursop (*Annona muricata* LINN)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	18 - 25	25 - 30 15 - 18	30 - 35 10 - 15	> 35 < 10
Water Availability (wa)				
Rain fall (mm)	1.000 - 2.500	500 - 1.000 2.500 - 3.000	250 - 500 3.000 - 4.000	< 250 > 4.000
Humidity (%)	> 42	36 - 42	30 - 36	< 30
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	somewhat fine, fine	Moderate	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,5 - 6,5	5,0 - 5,5 6,5 - 8,0	< 5,0 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Soodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 125	100 - 125	60 - 100	< 60
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 30	> 30
Erosion Hazard	very slight	Slight - Moderate	Severe	very severe
Flooding/Inundation Hazard				
during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	< 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Custard Apple (*Annona squamosa*)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	18 - 25	25 - 30 15 - 18	30 - 35 10 - 15	> 35 < 10
Water Availability (wa)				
Rain fall (mm)	1.000 - 2.000	500 - 1.000 2.000 - 3.000	250 - 500 3.000 - 4.000	< 250 > 4.000
Humidity (%)	> 42	36 - 42	30 - 36	< 30
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	Very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine	Moderate	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	-
Base saturation (%)	> 20	≤ 20	≤ 20	
pH H ₂ O	5,5 - 6,5	4,2 - 5,5 6,5 - 7,0	< 4,2 > 7,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 2	2 - 3	3 - 4	> 4
Soodicity (xn)				
Alkalinity/ESP (%)	-	-	-	-
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 125	100 - 125	60 - 100	< 60
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 30	> 30
Erosion Hazard	very slight	Slight - Moderate	Severe	very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	25	25 - 50	> 50
- Duration (day)	-	< 7	7 - 14	> 14
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Breadfruit (*Artocarpus communis* FORST)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (C)	22 - 28	28 - 34 18 - 22	34 - 40 15 - 18	> 40 < 15
Water Availability (wa)				
Rain fall (mm)	1.000 - 2.500	500 - 1.000 2.500 - 4.000	250 - 500 4.000 - 6.000	< 250 > 6.000
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine	Moderate	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,0 - 6,0	4,5 - 5,0 6,0 - 7,5	< 4,5 > 7,5	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Sodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 125	100 - 125	60 - 100	< 60
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	very slight	Slight - Moderate	Severe	very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	25	25 - 50	> 50
- Duration (day)	-	< 7	7 - 14	> 14
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Snakefruit (*Salacca edulis*)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	22 - 28	28 - 34 18 - 22	34 - 40 15 - 18	> 40 < 15
Water Availability (wa)				
Rain fall (mm)	1.000 - 2.000	500 - 1.000 2.000 - 3.000	250 - 500 3.000 - 4.000	< 250 > 4.000
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine, Moderate	fine, somewhat fine, Moderate	somewhat coarse, very fine	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 75	> 75	50 - 75	< 50
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	6,0 - 7,0	4,5 - 6,0 7,0 - 7,5	< 4,5 > 7,5	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Depth	Moderate	Low- Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Soodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 125	100 - 125	60 - 100	< 60
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 30	> 30
Erosion Hazard	very slight	Slight - Moderate	Severe	very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	25	25 - 50	> 50
- Duration (day)	-	< 7	7 - 14	> 14
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Sapodilla (*Marchas zapota*)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	18 - 25	25 - 30 15 - 18	30 - 35 10 - 15	> 35 < 10
Water Availability (wa)				
Rain fall (mm)	1.000 - 2.000	500 - 1.000 2.000 - 3.000	250 - 500 3.000 - 4.000	< 250 > 4.000
Humidity (%)	> 42	36 - 42	30 - 36	< 30
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	somewhat fine, somewhat fine	Moderate	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,5 - 7,8	5,0 - 5,5 7,8 - 8,0	< 5,0 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Soodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 125	100 - 125	60 - 100	< 60
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 30	> 30
Erosion Hazard	very slight	Slight - Moderate	Severe	very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	< 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Longan (*Euphoria longan* LAMK)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	18 - 25	25 - 30 15 - 18	30 - 35 10 - 15	> 35 < 10
Water Availability (wa)				
Rain fall (mm)	1.000 - 2.000	500 - 1.000 2.000 - 3.000	250 - 500 3.000 - 4.000	< 250 > 4.000
Humidity (%)	> 42	36 - 42	30 - 36	< 30
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	somewhat fine, fine	Moderate	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,5 - 7,8	5,0 - 5,5 7,8 - 8,0	< 5,0 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Depth	Moderate	Low- Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Soodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 30	> 30
Erosion Hazard	very slight	Slight - Moderate	Severe	very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	< 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Mangosteen (*Garcinia mangostana* LINN)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	20 - 23	23 - 30 18 - 20	30 - 40 15 - 18	> 40 < 15
Water Availability (wa)				
Rain fall (mm)	1.250 - 1.750	1.750 - 2.000 1.000 - 1.250	2.000 - 2.500 750 - 1.000	> 2.500 < 750
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine	Moderate	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,0 - 6,0	4,5 - 5,0 6,0 - 7,5	< 4,5 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Depth	Moderate	Low- Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Soodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 125	100 - 125	60 - 100	< 60
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	very slight	Slight - Moderate	Severe	very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	25	25 - 50	> 50
- Duration (day)	-	< 7	7 - 14	> 14
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Pineapple (*Ananas comosus* (L.) MERR.)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	20 - 26	26 - 30 18 - 20	30 - 35 16 - 18	> 35 < 16
Water Availability (wa)				
Rain fall (mm)	1.000 - 1.600	800 - 1.000 1.600 - 2.000	600 - 800 > 2.000	< 600
Air Humidity (%)	> 50	40 - 50	30 - 40	< 30
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine, Moderate	somewhat coarse	very fine	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 60	40 - 60	20 - 40	< 20
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,0 - 6,5	4,3 - 5,0 6,5 - 7,0	< 4,3 > 7,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 2	2 - 3	3 - 4	> 4
Sodicity (xn)				
Alkalinity/ESP (%)	< 10	10 - 15	15 - 20	> 20
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 75	50 - 75	30 - 50	< 30
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 30	> 30
Erosion Hazard	very slight	Slight - Moderate	Severe	very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	< 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Strawberry (*Fragaria vesca* LINN)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	17 - 20	20 - 30 15 - 17	30 - 35 10 - 15	> 35 < 10
Water Availability (wa)				
Rain fall (mm)	1.000 - 2.000	500 - 1.000 2.000 - 3.000	250 - 500 3.000 - 4.000	< 250 < 4.000
Humidity (%)	> 42	36 - 42	30 - 36	< 30
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	Moderate, somewhat fine, fine	Moderate, somewhat fine, fine	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 50	30 - 50	15 - 30	< 15
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 150	>150
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,5 - 7,3	5,0 - 5,5 7,3 - 8,0	< 5,0 > 8,0	
Organic-C (%)	> 2,0	0,8 - 2,0	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Depth	Moderate	Low-Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Soodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 125	100 - 125	60 - 100	< 60
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	Slight- Moderate	Severe-very severe
Flooding/Inundation Hazard				
during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	<7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Grape (*Vitis sp.*)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	22 - 28	28 - 32 18 - 22	32 - 36 16 - 18	> 36 < 16
Water Availability (wa)				
Rain fall (mm)	1.000 - 2.000	800 - 1.000 3.000 - 3.500	500 - 800 3.000 - 4.000	< 500 > 4.000
Duration of dry period (month)	3 - 4	2 - 3 4 - 6	6 - 7 1 - 2	> 6 < 1
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	somewhat fine, fine	somewhat coarse, Moderate	very fine	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	≥ 35	20-35	< 20	
pH H ₂ O	5,5 - 7,3	5,2 - 5,5 7,3 - 8,0	< 5,2 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Depth	Moderate	Low-Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 3	3 - 4	4 - 6	> 6
Sodicity (xn)				
Alkalinity/ESP (%)	< 8	8 - 12	12 - 15	> 15
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 125	100 - 125	60 - 100	< 60
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 30	> 30
Erosion Hazard	very slight	Slight - Moderate	Severe	very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	< 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Passion Fruit (*Passiflora edulis* SIMS.)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	16 - 18	18 -22 14 - 16	22 - 30 12 - 14	> 30 < 12
Water Availability (wa)				
Rain fall (mm)	2.000 - 2.500	1.500 - 2.000 2.500 - 3.000	800 - 1.500 3.000 - 4.000	< 800 > 4.000
Durationnya of dry period (month)	1 - 2	2 - 3	3 - 4	> 4 < 1
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	somewhat fine,fine	somewhat coarse, Moderate	very fine	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	>200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	≥ 35	20-35	< 20	
pH H ₂ O	5,5 - 7,3	5,2 - 5,5 7,3 - 8,0	< 5,2 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	very Low	-
P ₂ O ₅ (mg/100 g)	Depth	Moderate	Low- Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 3	3 - 4	4 - 6	> 6
Soodicity (xn)				
Alkalinity/ESP (%)	< 8	8 - 12	12 - 15	> 15
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 125	100 - 125	60 - 100	< 60
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	very slight	Slight - Moderate	Severe	very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	<7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Mountain papaya (*Carica pubescens*)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	18 - 20	20 - 22 15 - 18	22 - 25 10 - 15	> 25 < 10
Water Availability (wa)				
Rain fall (mm)	1.000 - 2.000	500 - 1.000 2.000 - 3.000	250 - 500 3.000 - 6.000	< 250 > 6.000
Humidity (%)	> 42	36 - 42	30 - 36	< 30
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessivel y drained	very poorly drained, excessivel y drained
Rooting Media (rc)				
Texture	somewhat fine,fine	Moderate	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	>200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,5 - 7,8	5,0 - 5,5 7,8 - 8,0	< 5,0 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Soodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 30	> 30
Erosion Hazard	very slight	Slight - Moderate	Severe	very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	<7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Persimmon (*Diospyros kaki* LINN)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	18 - 20	20 - 25 15 - 18	25 - 35 10 - 15	> 35 < 10
Water Availability (wa)				
Rain fall (mm)	1.000 - 2.000	500 - 1.000 2.000 - 3.000	250 - 500 3.000 - 4.000	< 250 > 4.000
Humidity (%)	> 42	36 - 42	30 - 36	< 30
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessivel y drained	very poorly drained, excessivel y drained
Rooting Media (rc)				
Texture	somewhat fine, fine	Moderate	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	>200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,5 - 7,8	5,0 - 5,5 7,8 - 8,0	< 5,0 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Soodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	very slight	Slight - Moderate	Severe	very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	<7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Pangium (*Pangium edule* REINW)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	18 - 25	25 - 30 15 - 18	30 - 35 10 - 15	> 35 < 10
Water Availability (wa)				
Rain fall (mm)	1.000 - 2.000	500 - 1.000 2.000 - 3.000	250 - 500 3.000 - 6.000	< 250 > 6.000
Humidity (%)	> 42	36 - 42	30 - 36	< 30
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine	Moderate	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,5 - 7,8	5,0 - 5,5 7,8 - 8,0	< 5,0 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Sodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 125	100 - 125	60 - 100	< 60
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	very slight	Slight - Moderate	Severe	very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	< 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Rose (*Rosa sp.*)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	15 – 24	24 – 30 12 – 15	30 – 35 10 – 12	> 35 < 10
Water Availability (wa)				
Rain fall (mm)	1.000 – 2.000	500 – 1.000 2.000 – 3.000	250 – 500 3.000 – 4.000	< 250 > 4.000
Humidity (%)	> 42	36 – 42	30 – 36	< 30
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	Moderate, somewhat fine, fine	somewhat coarse	very fine	coarse
Coarse fragments (%)	< 15	15 – 35	35 – 55	> 55
Soil depth (cm)	> 50	> 50	30 – 50	< 30
Peat:				
Thickness (cm)	< 50	50 – 100	100 – 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 – 16	< 5	
Base saturation (%)	> 35	20 – 35	< 20	
pH H ₂ O	5,5 – 7,3	5,0 – 5,5 7,3 – 8,0	< 5,0 > 8,0	
Organic-C (%)	> 2,0	0,8 – 2,0	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 – 6	6 – 8	> 8
Sodicity (xn)				
Alkalinity/ESP (%)	< 15	15 – 20	20 – 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 100	75 – 100	40 – 75	< 40
Erosion Hazard (eh)				
Slope (%)	< 3	3 – 8	8 – 15	> 15
Erosion Hazard		Very slight	Slight- Moderate	Severe-very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	< 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 – 15	15 – 40	> 40
Rock outcrops (%)	< 5	5 – 15	15 – 25	> 25

Source : Ritung *et al.*, (2011)

Cananga (*Canarium odoratum* BAILL)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	18 - 25	25 - 30 15 - 18	30 - 35 10 - 15	> 35 < 10
Water Availability (wa)				
Rain fall (mm)	1.000 - 2.000	500 - 1.000 2.000 - 3.000	250 - 500 3.000 - 4.000	< 250 > 4.000
Humidity (%)	> 42	36 - 42	30 - 36	< 30
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessivel y drained	very poorly drained, excessivel y drained
Rooting Media (rc)				
Texture	somewhat fine, fine	Moderate	somewhat coarse	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,5 - 7,8	5,0 - 5,5 7,8 - 8,0	< 5,0 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Soodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 100	75 - 100	40 - 75	< 40
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 30	> 30
Erosion Hazard	very slight	Slight - Moderate	Severe	very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	< 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Tuberose (*Polianthes tuberosa* L.)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	18 - 25	25 - 30 15 - 18	30 - 35 10 - 15	> 35 < 10
Water Availability (wa)				
Rain fall (mm)	1.000 - 2.000	500 - 1.000 2.000 - 3.000	250 - 500 3.000 - 4.000	< 250 > 4.000
Humidity (%)	> 42	36 - 42	30 - 36	< 30
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	Moderate, somewhat fine, fine	somewhat coarse	very fine	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 50	> 50	30 - 50	< 30
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,5 - 7,8	5,0 - 5,5 7,8 - 8,0	< 5,0 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Sodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 100	75 - 100	40 - 75	< 40
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	Slight- Moderate	Severe-very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	< 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Hairbrass (*Deschampsia caespitosa*)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	18 - 25	25 - 30 15 - 18	30 - 35 10 - 15	> 35 < 10
Water Availability (wa)				
Rain fall (mm)	1.000 - 2.000	500 - 1.000 2.000 - 3.000	250 - 500 3.000 - 4.000	< 250 > 4.000
Humidity (%)	> 42	36 - 42	30 - 36	< 30
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	Moderate, somewhat fine, fine	somewhat coarse	very fine	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 75	50 - 75	30 - 50	< 30
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,5 - 7,8	5,0 - 5,5 7,8 - 8,0	< 5,0 > 8,0	
Organic-C (%)	> 2,0	0,8 - 2,0	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Sodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 100	75 - 100	40 - 75	< 40
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	Slight- Moderate	Severe-very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	< 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Gladiolus (*Gladiolus hybridus*)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	18 - 25	25 - 30 15 - 18	30 - 35 10 - 15	> 35 < 10
Water Availability (wa)				
Rain fall (mm)	1.000 - 2.000	500 - 1.000 2.000 - 3.000	250 - 500 3.000 - 4.000	< 250 > 4.000
Humidity (%)	> 42	36 - 42	30 - 36	< 30
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	Moderate, somewhat fine, fine	somewhat coarse	very fine	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 75	50 - 75	30 - 50	< 30
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,5 - 7,8	5,0 - 5,5 7,8 - 8,0	< 5,0 > 8,0	
Organic-C (%)	> 2,0	0,8 - 2,0	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Sodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 100	75 - 100	40 - 75	< 40
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	Slight-Moderate	Severe-very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	< 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Aster (*Aster sp.*)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	18 - 25	25 - 30 15 - 18	30 - 35 10 - 15	> 35 < 10
Water Availability (wa)				
Rain fall (mm)	1.000 - 2.000	500 - 1.000 2.000 - 3.000	250 - 500 3.000 - 4.000	< 250 > 4.000
Humidity (%)	> 42	36 - 42	30 - 36	< 30
Oxygen Availability (oa)				
Drainage	Well drained, Moderate	somewhat poorly drained	poorly drained, somewhat excessively drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	Moderate, somewhat fine, fine	somewhat coarse	very fine	coarse
Coarse fragments (%)	0 - 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 50	> 50	25 - 50	< 25
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,5 - 7,8	5,0 - 5,5 7,8 - 8,0	< 5,0 > 8,0	
Organic-C (%)	> 2,0	0,8 - 2,0	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	0 - 4	4 - 6	6 - 8	> 8
Sodicity (xn)				
Alkalinity/ESP (%)	0 - 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 100	75 - 100	40 - 75	< 40
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	Slight- Moderate	Severe-very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (day)	-	-	-	< 7
Land Preparation (lp)				
Surface rock (%)	0 - 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	0 - 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Sunflower (*Helianthus annuus*)

Land use requirements / land characteristics	Land suitability class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	18 - 26	26 - 28 16 - 18	28 - 30 13 - 16	> 30 < 13
Water Availability (wa)				
Rainfall during the growing period (mm)	400 - 900	900 - 1.300 300 - 400	> 1.300 230 - 500	< 250
Air Humidity (%)	42 - 90	36 - 42 > 90	30 - 36	< 30
Oxygen Availability (oa)				
Drainage	Well drained, somewhat poorly drained	somewhat excessively drained, Moderate	poorly drained	very poorly drained, excessively drained
Rooting Media (rc)				
Texture	fine, somewhat fine, Moderate	somewhat coarse	very fine	coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 75	50 - 75	30 - 50	< 30
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	>200
Decomposition level	Sapric	Sapric, hemic	hemic	fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	6,0 - 7,5	5,5 - 6,0 7,5 - 8,0	< 5,5 > 8,0	
Organic-C (%)	> 2,0	0,8 - 2,0	< 0,8	
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 9	9 - 12	> 12
Sodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfuric Hazard (xs)				
Sulfuric depth (cm)	> 100	75 - 100	40 - < 75	< 40
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	Slight-Moderate	Severe-very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	25	> 25
- Duration (day)	-	-	<7	≥ 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Land Suitability Criteria

INDUSTRIAL CROPS



Rubber (*Hevea brassiliensis* M.A.)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature				
Average temperature (°C)	26 - 30	30 - 34	-	> 34
Water Availability (wa)		24 - 26	22 - 24	< 22
Rainfall (mm)	2.500 - 3.000	2.000 - 2.500 3.000 - 3.500	1.500 - 2.000 3.500 - 4.000	< 1.500 > 4.000
Length of dry period (months)	1 - 2	2 - 3	3 - 4	> 4
Oxygen Availability (oa)				
Drainage	Well Drained	Moderate Drained	Somewhat Poorly Drained, Poorly Drained	Very Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	Fine, Somewhat fine	Moderate	Somewhat coarse	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 60	> 60
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat::				
Thickness (cm)	< 100	100 - 200	200 - 300	> 300
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	< 35	35 - 50	> 50	
pH H ₂ O	5,0 - 6,0	6,0 - 6,5 4,5 - 5,0	> 6,5 < 4,5	
Organic-C (%) (%)	> 0,8	≤ 0,8		
Available Nutrients (na)				
N total (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 0,5	0,5 - 1	1 - 2	> 2
Sodicity (xn)				
Alkalinity/ESP (%)	-	-	-	-
Sulfidic hazard (xs)				
Depth to sulfidic layer (cm)	> 175	125 - 175	75 - 125	< 75
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	Very slight	slight - Moderate	severe	very severe
Flooding/Inundation Hazard during planting period (fh) (fh)				
- Depth (cm)	-	-	25	> 25
Duration (day)	-	-	< 7	≥ 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.* (2011)

Coconut (*Cocos nicifera* L.)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature				
Average temperature (°C)	25 - 28	28 - 32 23 - 25	32 - 35 20 - 23	> 35 < 20
Water Availability (wa)				
Rain fall (mm)	2.000 - 3.000	1.300 - 2.000 3.000 - 4.000	1.000 - 1.300 4.000 - 5.000	< 1.000 > 5.000
Length of dry period (months)	0 - 2	2 - 4	4 - 6	> 6
Humidity (%)	> 60	50 - 60	< 50	
Oxygen Availability (oa)				
Drainage	Well Drained, Moderate Drained	Somewhat Poorly Drained	Poorly Drained Somewhat Excessively Drained	Very Poorly Drained,
Rooting Media (rc)				
Texture	Fine, Somewhat fine, Moderate	Somewhat coarse	Somewhat fine	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 100	100 - 200	200 - 300	> 300
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 20	≤ 20		
pH H ₂ O	5,2 - 7,5	4,8 - 5,2 7,5 - 8,0	< 4,8 > 8,0	
Organic-C (%) (%)	> 0,8	≤ 0,8		
Available Nutrients (na)				
N total (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 12	12 - 16	16 - 20	> 20
Soodicity (xn)				
Alkalinity/ESP (%)	-	-	-	-
Sulfidic hazard (xs)				
Depth to sulfidic layer (cm)	> 125	100 - 125	60 - 100	< 60
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	Very slight	slight - Moderate	severe	very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	25	> 25
Duration (day)	-	-	<7	≥ 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.* (2011)

Oil palm (*Elaeis guinensis* JACK.)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature				
Average temperature (°C)	25 - 28	22 - 25 28 - 32	20 - 22 32 - 35	< 20 > 35
Water Availability (wa)				
Rain fall (mm)	1.700 - 2.500	1.450 - 1.700 2.500 - 3.500	1.250 - 1.450 3.500 - 4.000	< 1.250 > 4.000
Number of dry months (months)	< 2	2 - 3	3 - 4	> 4
Oxygen Availability (oa)				
Drainage	Well Drained, Moderate Drained	Somewhat Poorly Drained	Poorly Drained Somewhat Excessively Drained	Very Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	Fine, Somewhat fine, Moderate	Fine, Somewhat fine, Moderate	Somewhat coarse	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 100	100 - 200	200 - 300	> 300
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 20	≤ 20		
pH H ₂ O	5,0 - 6,5	4,2 - 5,0 6,5 - 7,0	< 4,2 > 7,0	
Organic-C (%) (%)	> 0,8	≤ 0,8		
Available Nutrients (na)				
N total (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	High	Moderate	Low- Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 2	2 - 3	3 - 4	> 4
Sodicity (xn)				
Alkalinity/ESP (%)	-	-	-	-
Sulfidic hazard (xs)				
Depth to sulfidic layer (cm)	> 125	100 - 125	60 - 100	< 60
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	Very slight	slight - Moderate	severe	very severe
Flooding/Inundation Hazard during planting period (fh) (fh)				
- Depth (cm)	-	25	25-50	>50
Duration (day)	-	<7	7-14	>14
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.* (2011)

Arabica coffee (*Coffea arabica*)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature				
Average temperature (°C)	16 - 20	15 - 16 20 - 22	14 - 15 22 - 24	< 14 > 24
Elevation above sea level (m)	1000 - 1.500	1.500 - 1.700 700 - 1000	1.700 - 2.000 500 - 700	> 2.000 < 500
Water Availability (wa)				
Rain fall (mm)	1.200 - 1.800	1.000 - 1.200 1.800 - 2.000	2.000 - 3.000 800 - 1.000	> 3.000 < 800
Length of dry period (months)	1 - 4	< 1 4 - 5	5 - 6	> 6
Humidity (%)	40 - 70	30 - 40	20 - 30	< 20
Oxygen Availability (oa)		70 - 80	80 - 90	> 90
Drainage	Well Drained	Moderate	Somewhat Poorly Drained, Somewhat Excessively Drained	Poorly Drained, Very Poorly Drained,
Rooting Media (rc)				
Texture	Fine, Somewhat fine, Moderate	Fine, Somewhat fine, Moderate	Somewhat coarse	Coarse, Somewhat fine
Coarse fragments (%)	< 15	15 - 35	35 - 60	> 60
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 100	100 - 200	200 - 300	> 300
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 50	35 - 50	< 35	
pH H ₂ O	5,6 - 6,6	6,6 - 7,3	< 5,5; >7,4	
Organic-C (%) (%)	> 2,0	0,8 - 2,0	< 0,8	
Available Nutrients (na)				
N total (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	High	Moderate	Low- Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 0,5	-	0,5 - 2	> 2
Sodicity (xn)				
Alkalinity/ESP (%)	-	-	-	-
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 30	> 30
Erosion Hazard	Very slight	Slight - Moderate	severe	very severe
Flooding/Inundation Hazard during planting period (fh) (fh)				
- Depth (cm)	-	-	-	25
Duration (day)	-	-	-	<7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.* (2011)

Robusta Coffee (*Coffea canephora*)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature				
Average temperature (°C)	20 - 24	24 - 28	18 - 20 28 - 32	< 18 > 32
Water Availability (wa)				
Rain fall (mm)	2.000 - 3.000	1.750 - 2.000 3.000 - 3.500	1.500 - 1.750 3.500 - 4.000	< 1.500 > 4.000
Length of dry period (months)	2 - 3	3 - 5	5 - 6	> 6
Air humidity (%)	45 - 80	80-90 35-45	> 90 30-35	< 30
Oxygen Availability (oa)				
Drainage	Well Drained	Moderate	Somewhat Poorly Drained, Somewhat Excessively Drained	Poorly Drained, Very Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	Fine, Somewhat fine	Moderate	Somewhat coarse	Coarse, Somewhat fine
Coarse fragments (%)	< 15	15 - 35	35 - 60	> 60
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 100	100 - 200	200 - 300	> 300
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 20	≤ 20		
pH H ₂ O	5,3 - 6,0	6,0 - 6,5 5,0 - 5,3	> 6,5 < 5,3	
Organic-C (%) (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
N total (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	High	Moderate	Low- Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 1	-	1 - 2	> 2
Soodicity (xn)				
Alkalinity/ESP (%)	-	-	-	-
Sulfidic hazard (xs)				
Depth to sulfidic layer (cm)	> 175	125 - 175	75 - 125	< 75
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 30	> 30
Erosion Hazard	Very slight	slight - Moderate	severe	very severe
Flooding/Inundation Hazard during planting period (fh) (fh)				
- Depth (cm)	-	-	25	> 25
Duration (day)	-	-	<7	≥ 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.* (2011)

Cacao (*Theobroma cacao* L.)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature				
Average temperature (°C)	25 - 28	20 - 25 28 - 32	32 - 35	< 20 > 35
Water Availability (wa)				
Rain fall (mm)	1.500 - 2.500	2.500 - 3.000	1.250 - 1.500 3.000 - 4.000	< 1.250 > 4.000
Length of dry period (months)	1 - 2	2 - 3	3 - 4	> 4
Humidity (%)	40 - 65	65 - 75 35 - 40	75 - 85 30 - 35	> 85 < 30
Oxygen Availability (oa)				
Drainage	Well Drained, Moderate Drained	Somewhat Poorly Drained	Poorly Drained Somewhat Excessively Drained	Very Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	Fine, Somewhat fine	Moderate	Somewhat coarse, Somewhat fine	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 100	100 - 200	200 - 300	> 300
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	-
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	6,0 - 7,0	5,5 - 6,0 7,0 - 7,6	< 5,5 > 7,6	
Organic-C (%) (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
N total (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	High	Moderate	Low- Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 1,1	1,1 - 1,8	1,8-2,2	> 2,2
Soodicity (xn)				
Alkalinity/ESP (%)	-	-	-	-
Sulfidic hazard (xs)				
Depth to sulfidic layer (cm)	> 125	100 - 125	60 - 100	< 60
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 30	> 30
Erosion Hazard	Very slight	slight - Moderate	severe	very severe
Flooding/Inundation Hazard during planting period (fh) (fh)				
- Depth (cm)	-	-	25	> 25
Duration (day)	-	-	<7	≥ 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.* (2011)

Clove (*Eugenia aromatica* L.)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature				
Average temperature (°C) harian	25 - 28	28 - 32 20 - 25	32 - 35	> 35 < 20
Water Availability (wa)				
Rain fall (mm)	1.500 - 2.500	2.500 - 3.000	1.250 - 1.500 3.000 - 4.000	< 1.250 > 4.000
Air humidity (%)	≤ 70	> 70		
Length of dry period (months)	1 - 2	2 - 3	3 - 4	> 4
Oxygen Availability (oa)				
Drainage	Well Drained, Moderate Drained	Somewhat Poorly Drained	Poorly Drained Somewhat Excessively Drained	Very Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	Fine, Somewhat fine	Moderate	Somewhat coarse	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	-	-	-	-
Decomposition level	-	-	-	-
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 50	35 - 50	< 35	
pH H ₂ O	5,0 - 7,0	4,0 - 5,0 7,0 - 8,0	< 4,0 > 8,0	
Organic-C (%) (%)	> 0,8	≤ 0,8		
Available Nutrients (na)				
N total (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	High	Moderate	Low- Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 5	5 - 8	8 - 10	> 10
Soodicity (xn)				
Alkalinity/ESP (%)	< 10	10 - 15	15 - 20	> 20
Sulfidic hazard (xs)				
Depth to sulfidic layer (cm)	> 125	100 - 125	60 - 100	< 60
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	Very slight	slight - Moderate	severe	very severe
Flooding/Inundation Hazard during planting period (fh) (fh)				
- Depth (cm)	-	-	25	> 25
Duration (day)	-	-	<7	≥ 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.* (2011)

Tea (*Camellia sinensis* (L.) O.KUNTZE)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature				
Average daily temperature (°C)	19 - 21	21 - 24 17 - 19	24 - 27 14 - 17	> 27 < 14
Water Availability (wa)				
Rain fall (mm)	2.500 - 4.000	1.800 - 2.500 4.000 - 5.000	1.300 - 1.800 5.000 - 6.000	< 1.300 > 6.000
Air humidity (%)	≤ 70	60 - 70	50 - 60	< 50
Length of dry period (months)	0 - 2	2 - 3	3 - 4	> 4
Oxygen Availability (oa)				
Drainage	Well Drained, Moderate Drained	Somewhat Poorly Drained	Poorly Drained Somewhat Excessively Drained	Very Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	Fine, Somewhat fine	Moderate	Somewhat coarse	Coarse, Somewhat fine
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 100	100 - 200	200 - 300	> 300
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	< 20	20 - 35	> 35	
pH H ₂ O	4,5 - 5,5	3,8 - 4,5 5,5 - 5,8	< 3,8 > 5,8	
Organic-C (%)	> 0,8	≤ 0,8		
Available Nutrients (na)				
N total (%)	High	Moderate	Low- Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 2	2 - 3	3 - 4	> 4
Sodicity (xn)				
Alkalinity/ESP (%)	< 8	8 - 10	10 - 15	> 15
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	Very slight	slight - Moderate	severe	very severe
Flooding/Inundation Hazard during planting period (fh) (fh)				
- Depth (cm)	-	25	25-50	>50
Duration (day)	-	<7	7-14	>14
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.* (2011)

Tobacco (*Nicotiana tabacum* L.)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature				
Average temperature (°C) during the growing period	22 - 28	20 - 22 28 - 30	15 - 20 30 - 34	< 15 > 34
Water Availability (wa)				
Raifall During the growing period(mm)	600 - 1.200	1.200 - 1.400 500 - 600	> 1.400 400 - 500	< 400
Air humidity (%)	24 - 75	20 - 24 75 - 90	< 20 > 90	
Oxygen Availability (oa)				
Drainage	Well Drained, Moderate Drained	Somewhat Poorly Drained	Poorly Drained Somewhat Excessively Drained	Very Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	Moderate, Somewhat fine, fine	Somewhat coarse, Somewhat fine	Coarse	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 75	50 - 75	30 - 50	< 30
Peat:				
Thickness (cm)	< 100	100 - 200	200 - 300	> 300
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	-
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,5 - 6,2	5,2 - 5,5 6,2 - 6,8	< 5,2 > 6,8	
Organic-C (%) (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
N total (%)	High	Moderate	Low- Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 2	2 - 4	4 - 6	> 6
Soodicity (xn)				
Alkalinity/ESP (%)	< 10	10 - 15	15 - 20	> 20
Sulfidic hazard (xs)				
Depth to sulfidic layer (cm)	> 100	75 - 100	40 - 75	< 40
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	slight- Moderate	severe- very severe
Flooding/Inundation Hazard during planting period (fh) (fh)				
- Depth (cm)	-	-	-	25
Duration (day)	-	-	-	<7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.* (2011)

Sugarcane (*Saccharum officinarum*)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature				
Average temperature (°C) harian	24 - 30	30 - 32 22 - 24	32 - 34 21 - 22	> 34 < 21
Water Availability (wa)				
Ten-day rainfall (mm)	> 60	50 - 60	30 - 50	< 30
Air humidity (%)	≤ 70	> 70		
Sunshine duration (hours/years)	> 1.800	1.400 - 1.800	1.200 - 1.400	< 1.200
Oxygen Availability (oa)				
Drainage	Well Drained, Moderate Drained	Somewhat Poorly Drained	Poorly Drained Somewhat Excessively Drained	very Poorly Drained Excessively Drained
Rooting Media (rc)				
Texture	Fine, Somewhat fine, Moderate	Fine, Somewhat fine, Moderate	Somewhat coarse	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 75	> 75	50 - 75	< 50
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	-
Base saturation (%)	> 50	35 - 50	< 35	
pH H ₂ O	5,5 - 7,5	5,0 - 5,5 7,5 - 8,0	< 5,0 > 8,0	
Organic-C (%) (%)	> 0,8	≤ 0,8		
Available Nutrients (na)				
N total (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	High	Moderate	Low-Very Low	-
K ₂ O (mg/100 g)	High	Moderate	Low-Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 5	5 - 8	8 - 10	> 10
Soodicity (xn)				
Alkalinity/ESP (%)	< 10	10 - 15	15 - 20	> 20
Sulfidic hazard (xs)				
Depth to sulfidic layer (cm)	> 125	100 - 125	60 - 100	< 60
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very slight	slight- Moderate	severe- very severe
Flooding/Inundation Hazard during planting period (fh) (fh)				
- Depth (cm)	-	-	25	> 25
Duration (day)	-	-	<7	≥ 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.* (2011)

Cashew (*Anacardium occidentale* L.)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature				
Average temperature (°C)	25 - 28	28 - 30	30 - 35	> 35 < 25
Water Availability (wa)				
Rain fall (mm)	1.200 - 1.500	800 - 1.200 1.500 - 2.000	500 - 800 2.000 - 2.500	< 500 > 2.500
Length of dry period (months)	2,5 - 4	4 - 5	5 - 6	> 6
Oxygen Availability (oa)				
Drainage	Well Drained , Somewhat Poorly Drained	Somewhat, Excessively Drained, Moderate	Poorly Drained	very Poorly Drained Excessively Drained
Rooting Media (rc)				
Texture	Fine, Somewhat fine	Moderate	Somewhat coarse	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	-
Base saturation (%)	≥ 20	< 20		
pH H ₂ O	5,2 - 7,5	4,8 - 5,2 7,5 - 8,0	< 4,8 > 8,0	
Organic-C (%) (%)	> 0,8	≤ 0,8		
Available Nutrients (na)				
N total (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	High	Moderate	Low- Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 2	2 - 3	3 - 4	> 4
Sodicity (xn)				
Alkalinity/ESP (%)	< 15			≥ 15
Sulfidic hazard (xs)				
Depth to sulfidic layer (cm)	> 125	100 - 125	60 - 100	< 60
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	Very slight	slight - Moderate	severe	very severe
Flooding/Inundation Hazard during planting period (fh) (fh)				
- Depth (cm)	-	-	-	25
Duration (day)	-	-	-	< 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.* (2011)

Melinjo (*Gnetum gnemon* LINN)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature				
Average temperature (°C) harian	25 - 28	28 - 32 20 - 25	32 - 35	> 35 < 20
Water Availability (wa)				
Rain fall (mm)	1.500 - 2.500	2.500 - 3.000	1.250 - 1.500 3.000 - 4.000	< 1.250 > 4.000
Air humidity (%)	≤ 70	> 70		
Length of dry period (months)	1 - 2	2 - 3	3 - 4	> 4
Oxygen Availability (oa)				
Drainage	Well Drained, Moderate Drained	Somewhat Poorly Drained	Poorly Drained Somewhat Excessively Drained	Very Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	Fine, Somewhat fine	Moderate	Somewhat coarse	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 100	100 - 200	200 - 300	> 300
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 50	35 - 50	< 35	
pH H ₂ O	5,0 - 7,0	4,0 - 5,0 7,0 - 8,0	< 4,0 > 8,0	
Organic-C (%) (%)	> 0,8	≤ 0,8		
Available Nutrients (na)				
N total (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 5	5 - 8	8 - 10	> 10
Soodicity (xn)				
Alkalinity/ESP (%)	< 10	10 - 15	15 - 20	> 20
Sulfidic hazard (xs)				
Depth to sulfidic layer (cm)	> 125	100 - 125	60 - 100	< 60
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	Very slight	slight - Moderate	severe	very severe
Flooding/Inundation Hazard during planting period (fh) (fh)				
- Depth (cm)	-	-	25	> 25
Duration (day)	-	-	<7	≥ 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Cotton (*Gossypium hirsutum*)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature				
Average temperature (°C)	26 - 28	28 - 30 22 - 26	30 - 35 -	> 35 < 22
Water Availability (wa)				
Rain fall (mm)	1.000 - 1.500	1.500 - 1.750 700 - 1.000	1.750 - 2.200 600 - 700	> 2.200 < 600
Humidity (%)	< 65	65 - 75	75 - 80	> 80
Oxygen Availability (oa)				
Drainage	Well Drained, Moderate Drained	Somewhat Poorly Drained	Poorly Drained Somewhat Excessively Drained	very Poorly Drained Excessively Drained
Rooting Media (rc)				
Texture	Fine, Somewhat fine, Moderate	Fine, Somewhat fine, Moderate	Somewhat coarse	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 75	50 - 75	30 - 50	< 30
Peat:				
Thickness (cm)	< 100	100 - 200	200 - 300	> 300
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 50	35 - 50	< 35	
pH H ₂ O	6,0 - 7,6	5,6 - 6,0 7,6 - 8,0	< 5,6 > 8,0	
Organic-C (%) (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
N total (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	High	Moderate	Low- Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 10	10 - 12	12 - 16	> 16
Sodicity (xn)				
Alkalinity/ESP (%)	< 20	20 - 30	30 - 40	> 40
Sulfidic hazard (xs)				
Depth to sulfidic layer (cm)	> 125	100 - 125	60 - 100	< 60
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 30	> 30
Erosion Hazard	Very slight	slight - Moderate	severe	very severe
Flooding/Inundation Hazard during planting period (fh) (fh)				
- Depth (cm)	-	-	25	> 25
Duration (day)	-	-	<7	≥ 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.* (2011)

Kapok (*Ceiba pantandra* (L.) GAERTN)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature				
Average temperature (°C)	26 – 28	22 – 26 28 – 30	20 – 22 30 – 35	< 20 > 35
Water Availability (wa)				
Rain fall (mm)	1.000 – 1.500	700 – 1.000 1.500 – 1.750	500 – 700 1.750 – 2.500	< 500 > 2.500
Oxygen Availability (oa)				
Drainage	Well Drained, Moderate Drained	Somewhat Poorly Drained	Poorly Drained Somewhat Excessively Drained	Very Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	fine, Somewhat fine	Moderate	Somewhat coarse	Coarse
Coarse fragments (%)	< 15	15 – 35	35 – 55	> 55
Soil depth (cm)	> 100	75 – 100	50 – 75	< 50
Peat:				
Thickness (cm)	< 100	100 – 200	200 – 300	> 300
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 – 16	< 5	
Base saturation (%)	> 35	20 – 35	< 20	
pH H ₂ O	5,0 – 6,0	4,5 – 5,0 6,0 – 7,5	< 4,5 > 7,5	
Organic-C (%) (%)	> 1,2	0,8 – 1,2	< 0,8	
Available Nutrients (na)				
N total (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 – 6	6 – 8	> 8
Sodicity (xn)				
Alkalinity/ESP (%)	< 15	15 – 20	20 – 25	> 25
Sulfidic hazard (xs)				
Depth to sulfidic layer (cm)	> 175	125 – 175	75 – 125	< 75
Erosion Hazard (eh)				
Slope (%)	< 8	8 – 15	15 – 40	> 40
Erosion Hazard	Very slight	slight – Moderate	severe	very severe
Flooding/Inundation Hazard during planting period (fh) (fh)				
– Depth (cm)	-	25	25-50	>50
Duration (day)	-	<7	7-14	>14
Land Preparation (lp)				
Surface rock (%)	< 5	5 – 15	15 – 40	> 40
Rock outcrops (%)	< 5	5 – 15	15 – 25	> 25

Source: Ritung *et al.* (2011)

Quinine (*Cinchona spec.div.*)

Land use requirements / land characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature				
Average temperature (°C)	17 - 21	21 - 24 17 - 18	24 - 27 14 - 17	> 27 < 14
Water Availability (wa)				
Rain fall (mm)	1.000 - 2.000	500 - 1.000 2.000 - 3.000	250 - 500 3.000 - 4.000	< 250 > 4.000
Humidity (%)	> 42	36 - 42	30 - 36	< 30
Oxygen Availability (oa)				
Drainage	Well Drained, Moderate Drained	Somewhat Poorly Drained	Poorly Drained Somewhat Excessively Drained	Very Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	Somewhat fine, fine	Moderate	Somewhat coarse	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 100	100 - 200	200 - 300	> 300
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,5 - 7,8	5,0 - 5,5 5,5 - 7,8	< 5,0 5,0 - 5,5	< 5,0
Organic-C (%) (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients (na)				
N total (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Sodicity (xn)				
Alkalinity/ESP (%)	< 15	15 - 20	20 - 25	> 25
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	Very slight	slight - Moderate	severe	very severe
Flooding/Inundation Hazard during planting period (fh) (fh)				
- Depth (cm)	-	-	-	25
Duration (day)	-	-	-	<7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.* (2011)

Land Suitability Criteria

SPICE AND MEDICINAL CROPS



Pepper (*Piper nigrum* LINN)

Land Use Requirements/ Land Characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	23 - 32	20 - 23 32 - 34		> 34 < 20
Water Availability (wa)				
Rainfall (mm)	2.000 - 2.500	2.500 - 3.000	3.000 - 4.000 1.500 - 2.000	< 1.500 > 4.000
Air humidity (%)	60 - 80	-	-	< 50 > 100
Length of Dry Period (months)	< 2	< 3	3 - 4	> 5
Oxygen Availability (oa)				
Drainage	Well drained, Moderate drained	Somewhat poorly drained	Poorly drained, Somewhat excessively drained	Very poorly drained, Excessively drained
Rooting Media (rc)				
Texture	Moderate, Somewhat fine, Fine	Somewhat coarse	Coarse, Very fine	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 75	50 - 75	30 - 50	< 30
Peat:				
Thickness (cm)	< 100	100 - 200	200 - 300	> 300
Decomposition level	Sapric	Sapric, hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 50	35 - 50	< 35	
pH H ₂ O	5,0 - 7,0	4,0 - 5,0 7,0 - 8,0	< 4,0 > 8,0	
Organic-C (%)	> 0,4	≤ 0,4		
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 5	5 - 8	8 - 10	> 10
Sodicity (xn)				
Alkalinity/ESP (%)	< 10	10 - 15	15 - 20	> 20
Sulfidic Hazard (xs)				
Sulfidic depth (cm)	> 100	75 - 100	40 - 75	< 40
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 30	> 30
Erosion Hazard	Very Slight	Slight - Moderate	Severe	Very Severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	25	> 25
- Duration (days)	-	-	< 7	≥ 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Nutmeg (*Myristika fragran* HOUTT)

Land Use Requirements/ Land Characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	25 - 30	18 - 24 31 - 34		> 34 < 18
Water Availability (wa)				
Rainfall (mm)	2.000 - 4.500	1.800 - 2.000	-	< 1.800
Rainfall (mm)		4.500 - 4.800	-	> 4.800
Air humidity (%)	≤ 75	> 75	-	-
Length of Dry Period (months)	tanpa	1 - 2	-	> 2
Oxygen Availability (oa) (oa)				
Drainage	Well drained, Moderate drained	Somewhat poorly drained	Poorly Drained, Somewhat Excessively Drained	Very Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	Moderate, Somewhat fine, Fine	Somewhat coarse	Coarse, Very fine	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 100	100 - 200	200 - 300	> 300
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 50	35 - 50	< 35	
pH H ₂ O	5,0 - 7,0	4,0 - 5,0 7,0 - 8,0	< 4,0 > 8,0	
Organic-C (%)	> 0,4	≤ 0,4		
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 5	5 - 8	8 - 10	> 10
Soodicity (xn)				
Alkalinity/ESP (%)	< 10	10 - 15	15 - 20	> 20
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	Very Slight	Slight - Moderate	Severe	Very Severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	25	> 25
- Duration (days)	-	-	<7	≥ 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source: Ritung *et al.*, (2011)

Cinnamon (*Cinnamomum burmanii* BL.)

Land Use Requirements/ Land Characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	18 - 22	22 - 25 15 - 18	25 - 27 -	> 27 < 15
Water Availability (wa)				
Rainfall (mm)	2.000 - 2.500	1.300 - 2.000 2.500 - 3.000	1.000 - 1.300 3.000 - 4.000	< 1.000 > 4.000
Air Humidity(%)	≤ 75		-	> 90, < 70
Length of Dry Period (months)	1	-	-	> 1
Oxygen Availability(oa)				
Drainage	Well drained, Moderate drained	Somewhat Poorly Drained	Poorly Drained, Somewhat Excessively Drained	Very Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	Moderate, Somewhat fine, Fine	Somewhat coarse	Coarse	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 100	100 - 200	200 - 300	> 300
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 50	35 - 50	< 35	
pH H ₂ O	5,0 - 7,0	4,0 - 5,0 7,0 - 8,0	< 4,0 > 8,0	
Organic-C (%)	> 0,4	≤ 0,4		
Available Nutrients(na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	High	Moderate	Low - Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 5	5 - 8	8 - 10	> 10
Soodicity (xn)				
Alkalinity/ESP/ESP (%)	< 10	10 - 15	15 - 20	> 20
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	Very Slight	Slight - Moderate	Severe	Very Severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	25	> 25
- Duration (days)	-	-	<7	≥ 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Candlenut (*Aleuriteus moluccana* WILLD)

Land Use Requirements/ Land Characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	21 - 27	28 - 34 18 - 21		> 34 < 18
Water Availability (wa)				
Rainfall (mm)	1.000 - 2.500	2.500 - 3.000 800 - 1.000	-	> 3.000 < 800
Air Humidity(%)	≤ 75	> 75	-	-
Length of Dry Period (months)	4 - 6	< 4	-	>6
Oxygen Availability(oa)				
Drainage	Well drained, Moderate drained	Somewhat Poorly Drained	Poorly Drained, Somewhat Excessively Drained	Very Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	Moderate, Somewhat fine, Fine	Somewhat coarse	Coarse, Very fine	-
Coarse fragments (%)	0 - 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)	< 100	100 - 200	200 - 300	> 300
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	-
Base saturation (%)	> 50	35 - 50	≤ 35	
pH H ₂ O	5,5 - 7,0	4,0 - 5,5 7,0 - 8,0	< 4,0 > 8,0	
Organic-C (%)	> 0,4	≤ 0,4		
Available Nutrients(na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 5	5 - 8	8 - 10	> 10
Soodicity (xn)				
Alkalinity/ESP/ESP (%)	< 10	10 - 15	15 - 20	> 20
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	Very Slight	Slight - Moderate	Severe	Very Severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	25	> 25
- Duration (days)	-	-	<7	≥ 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Vanilla (*Vanilla planifolia* ANDREW)

Land Use Requirements/ Land Characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	22 - 25	16 - 22 25 - 36		> 36 < 16
Water Availability (wa)				
Rainfall (mm)	1.500 - 2.000	1.000 - 1.500 2.000 - 2.500	800 - 1.500 2.500 - 4.000	< 800 > 4.000
Air Humidity(%)	60 - 80	-	-	< 50 >100
Length of Dry Period (months)	< 2	< 3	3 - 4	> 5
Oxygen Availability(oa)				
Drainage	Well drained, Moderate drained	Somewhat Poorly Drained	Poorly Drained, Somewhat Excessively Drained	Very Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	Moderate, Somewhat fine, Fine	Somewhat coarse	Coarse, Very fine	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 75	50 - 75	30 - 50	< 30
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 50	35 - 50	< 35	
pH H ₂ O	5,5 - 6,5	4,5 - 5,5 6,5 - 8,5	< 4,5 > 8,5	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients(na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	High	Moderate	Low - Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 5	5 - 8	8 - 10	> 10
Sodicity (xn)				
Alkalinity/ESP/ESP (%)	< 10	10 - 15	15 - 20	> 20
Sulfidic Hazard (xs)				
Sulfidic depth (cm)	> 100	75 - 100	40 - 75	< 40
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 30	> 30
Erosion Hazard	Very Slight	Slight - Moderate	Severe	Very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	25	> 25
- Duration (days)	-	-	<7	≥ 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Lemongrass (*Andropogon nardus* var. *ceriferus*)

Land Use Requirements/ Land Characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	12 - 24	24 - 27 10 - 12	27 - 30 8 - 10	> 30 < 8
Water Availability (wa)				
Rainfall (mm)	2.000 - 3.000	3.000 - 3.500 1.750 - 2.000	3.500-4.000 1.500-1.750	> 4.000 < 1.500
Humidity (%)	42 - 75	36 - 42 75 - 90	30 - 36 > 90	< 30
Oxygen Availability(oa)				
Drainage	Well drained, Somewhat Poorly Drained	Somewhat Excessively Drained, Moderate	Poorly Drained Excessively Drained	Very Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	Fine, Somewhat fine, Moderate	Fine, Somewhat fine, Moderate	Somewhat coarse, Very fine	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 75	50 - 75	25 - 50	< 25
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 50	35 - 50	< 35	
pH H ₂ O	5,6 - 7,6	5,4 - 5,6 7,6 - 8,0	< 5,4 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients(na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 1	1 - 1,5	1,5 - 2	> 2
Soodicity (xn)				
Alkalinity/ESP/ESP (%)	< 5	5 - 8	8 - 12	> 12
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 30	> 30
Erosion Hazard	Very Slight	Slight- Moderate	Severe	Very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	25	> 25
- Duration (days)	-	-	<7	≥ 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Vetiver Root (*Vetiveria zizanoides*)

Land Use Requirements/ Land Characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	18 - 20	20 - 27 10 - 12	27 - 30 8 - 10	> 30 < 8
Water Availability (wa)				
Rainfall (mm) during the growing period	350 - 600	600 - 1.000 300 - 350	> 1.000 230 - 500	< 250
Humidity (%)	42 - 75	36 - 42 75 - 90	30 - 36 > 90	< 30
Oxygen Availability(oa)				
Drainage	Well drained, Somewhat Poorly Drained	Somewhat Excessively Drained, Moderate Drained	Poorly Drained	Very Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	Fine, Somewhat fine, Moderate	Somewhat coarse	Coarse	-
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 75	50 - 75	30 - 50	< 30
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 50	35 - 50	< 35	
pH H ₂ O	5,6 - 7,6	5,4 - 5,6 7,6 - 8,0	< 5,4 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients(na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 1	1 - 1,5	1,5 - 2	> 2
Sodicity (xn)				
Alkalinity/ESP/ESP (%)	< 5	5 - 8	8 - 12	> 12
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 30	> 30
Erosion Hazard	Very Slight	Slight-Moderate	Severe	Very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	25	> 25
- Duration (days)	-	-	<7	≥ 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Ginger (*Zingiber officinale*)

Land Use Requirements/ Land Characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	25 - 30	-	30 - 35 20 - 25	> 35 < 20
Water Availability (wa)				
Rainfall (mm)	2.500 - 3.500	3.500 - 4.000 1.800 - 2.500	- -	< 1.800 > 4.000
Air Humidity(%)				
Length of Dry Period (months)	< 3	3 - 5		> 5
Oxygen Availability(oa)				
Drainage	Well Drained, Moderate Drained	Somewhat Poorly Drained	Poorly Drained, Somewhat Excessively Drained	Very Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	Somewhat coarse,Moderate	Somewhat fine,Fine	Very fine	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 50	> 50	30 - 50	< 30
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 50	35 - 50	< 35	
pH H ₂ O	5,0 - 7,0	4,0 - 5,0 7,0 - 8,0	< 4,0 > 8,0	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients(na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	High	Moderate	Low-Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 5	5 - 8	8 - 10	> 10
Soodicity (xn)				
Alkalinity/ESP/ESP (%)	< 10	10 - 15	15 - 20	> 20
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very Slight	Slight-Moderate	Severe- Very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	25	> 25
- Duration (days)	-	-	<7	≥ 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Aromatic Ginger (*Kaempferia galanga* L.)

Land Use Requirements/ Land Characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	22 - 28	28 - 34 18 - 22	34 - 40 15 - 18	> 40 < 15
Water Availability (wa)				
Rainfall (mm)	1.000 - 2.000	500 - 1.000 2.000 - 3.000	250 - 500 3.000 - 4.000	< 250 > 4.000
Oxygen Availability(oa)				
Drainage	Well Drained , Moderate Drained	Somewhat Poorly Drained	Poorly Drained, Somewhat Excessively Drained	Very Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	Somewhat fine,Moderate	Fine	Somewhat coarse, Very fine	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 50	> 50	25 - 50	< 25
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,0 - 6,0	4,5 - 5,0 6,0 - 7,5	< 4,5 > 7,5	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients(na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Sodicity (xn)				
Alkalinity/ESP/ESP (%)	< 15	15 - 20	20 - 25	> 25
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very Slight	Slight - Moderate	Severe - Very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	25	25-50	>50
- Duration (days)	-	<7	7-14	>14
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Turmeric (*Curcuma domestica* VAL)

Land Use Requirements/ Land Characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	22 - 28	28 - 34 18 - 22	34 - 40 15 - 18	> 40 < 15
Water Availability (wa)				
Rainfall (mm)	1.000 - 2.000	500 - 1.000 2.000 - 3.000	250 - 500 3.000 - 4.000	< 250 > 4.000
Oxygen Availability(oa)				
Drainage	Well Drained, Moderate Drained	Somewhat Poorly Drained	Poorly Drained, Somewhat Excessively Drained	Very Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	Somewhat fine, Moderate	Fine	Somewhat coarse, Very fine	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 50	> 50	25 - 50	< 25
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,0 - 6,0	4,5 - 5,0 6,0 - 7,5	< 5,5 > 7,5	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients(na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Soodicity (xn)				
Alkalinity/ESP/ESP (%)	< 15	15 - 20	20 - 25	> 25
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very Slight	Slight- Moderate	Severe-Very severe
Flooding/Inundation				
Hazard during planting period (fh)				
- Depth (cm)	-	25	25-50	>50
- Duration (days)	-	<7	7- 14	>14
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Galangal (*Alpinia galanga sw.*)

Land Use Requirements/ Land Characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	22 - 28	28 - 34 18 - 22	34 - 40 15 - 18	> 40 < 15
Water Availability (wa)				
Rainfall (mm)	1.000 - 2.000	500 - 1.000 2.000 - 3.000	250 - 500 3.000 - 4.000	< 250 > 4.000
Oxygen Availability(oa)				
Drainage	Well Drained, Moderate Drained	Somewhat Poorly Drained	Poorly Drained , Somewhat Excessively Drained	Very Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	Fine, Somewhat fine, Moderate	Fine, Somewhat fine, Moderate	Somewhat coarse, Very fine	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 50	> 50	30 - 50	< 30
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	5,0 - 6,0	4,5 - 5,0 6,0 - 7,5	< 4,5 > 7,5	
Organic-C (%)	> 1,2	0,8 - 1,2	< 0,8	
Available Nutrients(na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Soodicity (xn)				
Alkalinity/ESP/ESP (%)	< 15	15 - 20	20 - 25	> 25
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very Slight	Slight- Moderate	Severe-Very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	25	25-50	>50
- Duration (days)	-	<7	7-14	>14
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Cardamom (*Elettoria cardomommum*)

Land Use Requirements/ Land Characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	20 - 30	18 - 32	18 - 32	> 32 < 18
Water Availability (wa)				
Rainfall (mm)	2.000 - 4.100	4.100 - 7.000 1.500 - 2.000	4.100 - 7.000 1.500 - 2.000	> 7.000 < 1.500
Air Humidity(%)				
Length of Dry Period (months)	< 3	3 - 4	4 - 6	> 6
Oxygen Availability(oa)				
Drainage	Well Drained, Moderate Drained	Somewhat Poorly Drained	Poorly Drained, Somewhat Excessively Drained	Very Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	Somewhat coarse, Moderate, Somewhat fine, Fine	Somewhat coarse, Moderate, Somewhat fine, Fine	Coarse, Very fine	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 50	> 50	25 - 50	< 25
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 50	35 - 50	< 35	
pH H ₂ O	5,0 - 7,0	4,0 - 5,0 7,0 - 7,5	< 4,0 > 7,5	
Organic-C (%)	> 0,4	≤ 0,4		
Available Nutrients(na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 5	5 - 8	8 - 10	> 10
Soodicity (xn)				
Alkalinity/ESP/ESP (%)	< 10	10 - 15	15 - 20	> 20
Erosion Hazard (eh)				
Slope (%)	< 3	3 - 8	8 - 15	> 15
Erosion Hazard		Very Slight	Slight - Moderate	Severe - Very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	25	> 25
- Duration (days)	-	-	<7	≥ 7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Jatropha (Ricinus communis)

Land Use Requirements/ Land Characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	24 - 30	20 - 24 30 - 32	16 - 20 > 32	< 16
Water Availability (wa)				
Rainfall (mm) during the growing period	700 - 1.400	1.400 - 1.800 600 - 700	> 1.800 500 - 600	< 500
Humidity (%)	24 - 75	20 - 24 75 - 90	< 20 > 90	
Oxygen Availability(oa)				
Drainage	Well Drained, Somewhat Poorly Drained	Somewhat Excessively Drained, Moderate	Poorly Drained	Very Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	Moderate, Somewhat fine, Fine	Somewhat coarse	Coarse	Coarse
Coarse fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil depth (cm)	> 75	50 - 75	30 - 50	< 30
Peat:				
Thickness (cm)	< 50	50 - 100	100 - 200	> 200
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base saturation (%)	> 35	20 - 35	< 20	
pH H ₂ O	6,0 - 7,0	5,5 - 6,0 7,0 - 7,2	< 5,5 > 7,2	
Organic-C (%)	> 1,2	0,8 - 1,2	≤ 0,8	
Available Nutrients(na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Sodicity (xn)				
Alkalinity/ESP/ESP (%)	< 15	15 - 20	20 - 25	> 25
Sulfidic Hazard (xs)				
Sulfidic depth (cm)	> 100	75 - 100	40 - 75	< 40
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 30	> 30
Erosion Hazard	Very Slight	Slight - Moderate	Severe	Very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	-	-	25
- Duration (days)	-	-	-	<7
Land Preparation (lp)				
Surface rock (%)	< 5	5 - 15	15 - 40	> 40
Rock outcrops (%)	< 5	5 - 15	15 - 25	> 25

Source : Ritung *et al.*, (2011)

Sesame (*Sesamum indicum* L.)

Land Use Requirements/ Land Characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	20 – 28	18 – 20 28 – 30	16 – 18 30 – 38	< 16 > 38
Water Availability (wa)				
First month rainfall (mm)	30 – 300	25 – 50 300 – 475	< 25 > 475	
Second month rainfall (mm)	100 – 275	50 – 100 275 – 475	25 – 50 > 475	< 25
Third month rainfall (mm)	< 120	120 – 200	> 200	
Humidity (%)	< 65	65 – 75	75 – 85	< 85
Oxygen Availability(oa)				
Drainage	Well Drained, Somewhat Poorly Drained	Somewhat Excessively Drained, Moderate Drained	Poorly Drained	Very Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	Fine, Somewhat fine, Moderate	Somewhat coarse	Coarse, Very fine	Coarse
Coarse fragments (%)	< 15	15 – 35	35 – 55	> 55
Soil depth (cm)	> 50	> 50	30 – 50	< 30
Peat:				
Thickness (cm)	< 50	50 – 100	100 – 200	> 200
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 – 16	< 5	
Base saturation (%)	> 50	35 – 50	≤ 35	
pH H ₂ O	5,8 – 7,0	5,5 – 5,8 7,0 – 7,5	< 5,5 > 7,5	
Organic-C (%)	> 0,4	≤ 0,4		
Available Nutrients(na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 – 6	6 – 8	> 8
Soodicity (xn)				
Alkalinity/ESP/ESP (%)	-	-	-	-
Sulfidic Hazard (xs)				
Sulfidic depth (cm)	> 100	75 – 100	40 – 75	< 40
Erosion Hazard (eh)				
Slope (%)	< 8	8 – 15	15 – 30	> 30
Erosion Hazard	Very Slight	Slight – Moderate	Severe	Very severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	25	25-50	>50
- Duration (days)	-	<7	7-14	>14
Land Preparation (lp)				
Surface rock (%)	< 5	5 – 15	15 – 40	> 40
Rock outcrops (%)	< 5	5 – 15	15 – 25	> 25

Source : Ritung *et al.*, (2011)

CROPS



Teak (*Tectona grandis*)

Land Use Requirements/ Land Characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	25 - 30	30 - 35 21 - 25	30 - 35 21 - 25	> 35 < 21
Water Availability (wa)				
Rainfall (mm)	1500 - 2000	2000 - 2250 1250 - 1500	2250 - 2500 1000 - 1250	> 2500 < 1000
Dry Months	< 5	-	-	> 5
LGP				
Oxygen Availability (oa)				
Drainage	Well Drained	Somewhat Excessively Drained, Moderate Drained	Excessively Drained, Somewhat Poorly Drained	Poorly Drained, Very Poorly Drained, Very Excessively Drained
Rooting Media (rc)				
Texture	Moderate, Somewhat fine, Fine	Somewhat coarse, Very fine	Coarse, Very fine	-
Coarse Fragments (%)	< 15	15 - 35	35 - 55	> 55
Soil Depth (cm)	> 150	100 - 150	75 - 100	< 75
Peat:				
Thickness (cm)	-	-	-	-
Decomposition Level	-	-	-	-
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base Saturation (%)				
pH H ₂ O	5,5 - 7,0	7,0 - 7,5 5,0 - 5,5	7,5 - 8,0 4,5 - 5,0	> 8,0 < 4,5
Organic-C (%)	> 0,4	≤ 0,4		
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	
K ₂ O (mg/100 g)	Moderate	Low	Very Low	
Toxicity(xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Soodicity (xn)				
Alkalinity/ESP (%)				
Sulfidic hazard (xs)				
Sulfidic depth (cm)	> 175	125 - 175	75 - 125	< 75
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	Very Slight	Slight - Moderate	Severe	Very Severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	25	25-50	>50
- Duration (days)	-	<7	7-14	>14
Land Preparation (lp)				
Surface Rock (%)	< 3	3 - 15	15 - 40	> 40
Rock Outcrops (%)	< 2	2 - 10	10 - 25	> 25

Source : Ritung *et al.*, (2011)

Mahogany (*Swietenia mahagoni* (L.) Jacq.)

Land Use Requirements/ Land Characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature(°C)	25 - 30	30 - 35 21 - 25	-	> 35 < 21
Water Availability(wa)				
Rainfall (mm)	2000 - 3000	3000 - 3500 1750 - 2000	3500 - 4000 1500 - 1750	> 4000 < 1500
Dry Months LGP	< 3	3	3 - 4	> 4
Oxygen Availability (oa)				
Drainage	Well Drained	Somewhat Excessively Drained, Moderate	Excessively Drained, Somewhat Poorly Drained	Poorly Drained, Very Poorly Drained,Very Excessively Drained
Rooting Media (rc)				
Texture	Moderate, Somewhat fine	Somewhat coarse, Fine	Coarse, Very fine	-
Coarse Fragments (%)	-	-	-	-
Soil Depth (cm)	> 150	100 - 150	75 - 100	< 75
Peat:				
Thickness (cm)	Without	< 100	100 - 200	> 200
Decomposition Level	-	Sapric	Hemic	Hemic, Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base Saturation (%)				
pH H ₂ O	5,5 - 7,0	7,0 - 7,5 5,0 - 5,5	7,5 - 8,0 4,5 - 5,0	> 8,0 < 4,5
Organic-C (%)	> 0,4	≤ 0,4		
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	
K ₂ O (mg/100 g)	Moderate	Low	Very Low	
Toxicity(xc)				
Salinity (dS/m)	< 4	4 - 8	-	> 8
Soodicity (xn)				
Alkalinity/ESP (%)				
Sulfidic hazard (xs)				
Sulfidic depth (cm)	> 175	125 - 175	75 - 125	< 75
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	Very Slight	Slight - Moderate	Severe	Very Severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	25	25-50	>50
- Duration (days)	-	<7	7-14	>14
Land Preparation (lp)				
Surface Rock (%)	< 3	3 - 15	15 - 40	> 40
Rock Outcrops (%)	< 2	2 - 10	10 - 25	> 25

Source : Ritung *et al.*, (2011)

Agathis (Agathis loranthifolia)

Land Use Requirements/ Land Characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc) Average temperature(°C)	20 - 24	24 - 30 17 - 20	-	> 30 < 17
Water Availability(wa) Rainfall (mm)	2500 - 3000	3000 - 4000 2000 - 2500	-	> 2500 < 750
Dry Months LGP	< 1	1 - 3	3 - 4	> 4
Oxygen Availability (oa) Drainage	Well Drained, Moderate	Somewhat Excessively Drained, Somewhat Poorly Drained	Excessively Drained	Poorly Drained, Very Poorly Drained, Very Excessively Drained
Rooting Media (rc) Texture	Somewhat coarse, Moderate, Somewhat fine	Coarse, Fine, Very fine	Very fine	
Coarse Fragments (%)	-	-	-	-
Soil Depth (cm)	> 150	100 - 150	75 - 100	< 75
Peat: Thickness (cm)		< 100	100 - 200	> 200
Decomposition Level		Sapric	Hemic	Hemic, Fibric
Nutrient Retention (nr) Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base Saturation (%)				
pH H ₂ O	5,5 - 7,7	7,0 - 7,5 5,0 - 5,5	7,5 - 8,0 4,5 - 5,0	> 8,0 < 4,5
Organic-C (%)	> 0,8	≤ 0,8		
Available Nutrients (na) Total Nitrogen (%)	Moderate	Low	Very Low	
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	
K ₂ O (mg/100 g)	Moderate	Low	Very Low	
Toxicity(xc) Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Soodicity (xn) Alkalinity/ESP (%)				
Sulfidic hazard (xs) Sulfidic depth (cm)	> 125	100 - 125	75 - 100	< 75
Erosion Hazard (eh) Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	Very Slight	Slight - Moderate	Severe	Very Severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	25	25 - 50	>50
- Duration (days)	-	<7	7 - 14	>14
Land Preparation (lp) Surface Rock (%)	< 3	3 - 15	15 - 40	> 40
Rock Outcrops (%)	< 2	2 - 10	10 - 25	> 25

Source : Ritung *et al.*, (2011)

Altingia excelsa

Land Use Requirements/ Land Characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature(°C)	19 - 21	21 - 23 17 - 18	-	> 23 < 17
Water Availability(wa)				
Rainfall (mm)	2000 - 2500	2500 - 3000 1500 - 2000	< 1500	> 3000 < 1500
Dry Months	1 - 2	2 - 3 < 1	-	> 3
LGP				
Oxygen Availability (oa)				
Drainage	Well Drained	Moderate Drained, Somewhat Excessively Drained	Somewhat Poorly Drained, Excessively Drained	Poorly Drained, Very Excessively Drained, Very Poorly Drained
Rooting Media (rc)				
Texture	Moderate, Somewhat fine	Somewhat coarse, Fine, Very fine	Coarse, Very fine	
Coarse Fragments (%)	-	-	-	-
Soil Depth (cm)	> 150	100 - 150	75 - 100	< 75
Peat:				
Thickness (cm)		< 100	100 - 200	> 200
Decomposition Level		Sapric	Hemic	Hemic, Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base Saturation (%)				
pH H ₂ O	5,5 - 7,0	7,0 - 7,5 5,0 - 5,5	7,5 - 8,0 4,5 - 5,0	> 8,0 < 4,5
Organic-C (%)	> 0,4	≤ 0,4		
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	
K ₂ O (mg/100 g)	Moderate	Low	Very Low	
Toxicity(xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Soodicity (xn)				
Alkalinity/ESP (%)				
Sulfidic hazard (xs)				
Sulfidic depth (cm)	> 175	125 - 175	75 - 125	< 75
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	Very Slight	Slight - Moderate	Severe	Very Severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	25	25-50	>50
- Duration (days)	-	<7	7-14	>14
Land Preparation (lp)				
Surface Rock (%)	< 3	3 - 15	15 - 40	> 40
Rock Outcrops (%)	< 2	2 - 10	10 - 25	> 25

Source : Ritung *et al.*, (2011)

Albizia (Albizia falcataria)

Land Use Requirements/ Land Characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc) Average temperature(°C)	21 - 30	30 - 34 19 - 21	-	> 34 < 19
Water Availability(wa) Rainfall (mm)	2500 - 3000	3000 - 4000 2000 - 2500	-	> 4000 < 2000
Dry Months LGP	0 - 2	2 - 4	-	> 4
Oxygen Availability (oa) Drainage	Well Drained, Somewhat Excessively Drained, Moderate	Somewhat Poorly Drained , Somewhat Excessively Drained	Excessively Drained	Poorly Drained, Very Poorly Drained, Excessively Drained
Rooting Media (rc) Texture	Moderate, Somewhat fine, Fine	Coarse, Somewhat coarse	Very fine	
Coarse Fragments (%) Soil Depth (cm)		> 100	75 - 100	< 75
Peat: Thickness (cm) Decomposition Level		< 100 Sapric	100 - 200 Hemic	> 200 Hemic, Fibric
Nutrient Retention (nr) Soil Cation Exchange Capacity (cmol) Base Saturation (%) pH H ₂ O	> 16 5,5 - 7,0	5 - 16 7,0 - 7,5 5,0 - 5,5	< 5 7,5 - 8,0 4,5 - 5,0	> 8,0 < 4,5
Organic-C (%)	> 0,4	≤ 0,4		
Available Nutrients (na) Total Nitrogen (%) P ₂ O ₅ (mg/100 g) K ₂ O (mg/100 g)	Moderate Moderate Moderate	Low Low Low	Very Low Very Low Very Low	
Toxicity(xc) Salinity (dS/m)	< 2	2 - 4	4 - 8	> 8
Soodicity (xn) Alkalinity/ESP (%)				
Sulfidic hazard (xs) Sulfidic depth (cm)	> 175	125 - 175	75 - 125	< 75
Erosion Hazard (eh) Slope (%) Erosion Hazard	< 8 Very Slight	8 - 15 Slight - Moderate	15 - 40 Severe	> 40 Very Severe
Flooding/Inundation Hazard during planting period (fh) - Depth (cm) - Duration (days)	- -	25 <7	25-50 7-14	>50 >14
Land Preparation (lp) Surface Rock (%) Rock Outcrops (%)	< 3 2	3 - 15 2 - 10	15 - 40 10 - 25	> 40 > 25

Source : Ritung *et al.*, (2011)

Acacia (Acacia auriculiformia)

Land Use Requirements/ Land Characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature(°C)	23 - 30	30 - 34 21 - 23	-	> 34 < 21
Water Availability(wa)				
Rainfall (mm)	1300 - 2500	2500 - 4000 1000 - 1300	-	> 4000 < 1000
Dry Months	2 - 3	3 - 6 < 2	-	> 6
LGP				
Oxygen Availability (oa)				
Drainage	Well Drained, Somewhat Excessively Drained, Moderate	Somewhat Poorly Drained, Excessively Drained	Poorly Drained	Very Poorly Drained
Rooting Media (rc)				
Texture	Somewhat coarse, Moderate, Somewhat fine	Coarse, Fine	Very fine	
Coarse Fragments (%)	-	-	-	-
Soil Depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)		< 100	100 - 200	> 200
Decomposition Level		Sapric	Hemic	Hemic, Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	
Base Saturation (%)				
pH H ₂ O	7,0 - 7,5	7,5 - 8,0 6,0 - 7,0	8,0 - 8,5 5,0 - 6,0	> 8,5 < 5,0
Organic-C (%)	> 0,4	≤ 0,4		
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	
K ₂ O (mg/100 g)	Moderate	Low	Very Low	
Toxicity(xc)				
Salinity (dS/m)	< 4	4 - 8	8 - 12	> 12
Soodicity (xn)				
Alkalinity/ESP (%)				
Sulfidic hazard (xs)				
Sulfidic depth (cm)	> 125	100 - 125	75 - 100	< 75
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	Very Slight	Slight - Moderate	Severe	Very Severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	25	25-50	>50
- Duration (days)	-	<7	7-14	>14
Land Preparation (lp)				
Surface Rock (%)	< 3	3 - 15	15 - 40	> 40
Rock Outcrops (%)	< 2	2 - 10	10 - 25	> 25

Source : Ritung *et al.*, (2011)

Leucaena leucocephalla

Land Use Requirements/ Land Characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature(°C)	21 - 30	30 - 34 19 - 20	-	> 34 < 19
Water Availability(wa)				
Rainfall (mm)	750 - 1000	1000 - 2000 600 - 750	-	> 2000 < 600
Dry Months	3 - 4	4 - 6 < 3	-	> 6
LGP				
Oxygen Availability (oa)				
Drainage	Well Drained, Somewhat Excessively Drained, Moderate Drained	Somewhat Poorly Drained, Excessively Drained	Very Poorly Drained, Poorly Drained	Excessively Drained, Very Excessively Drained
Rooting Media (rc)				
Texture	Moderate, Somewhat fine, Fine	Somewhat coarse	Very fine	Coarse
Coarse Fragments (%)	-	-	-	-
Soil Depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)		< 100	100 - 200	> 200
Decomposition Level		Sapric	Hemic	Hemic, Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	>24	16 - 24	<16	
Base Saturation (%)				
pH H ₂ O	7,0 - 8,0	8,0 - 8,5 6,0 - 7,0	5,0 - 6,0	> 8,5 < 5,0
Organic-C (%)				
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	
K ₂ O (mg/100 g)	Moderate	Low	Very Low	
Toxicity(xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Sodicity (xn)				
Alkalinity/ESP (%)				
Sulfidic hazard (xs)				
Sulfidic depth (cm)	> 125	100 - 125	75 - 100	< 75
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	Very Slight	Slight - Moderate	Severe	Very Severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	25	25-50	>50
- Duration (days)	-	<7	7-14	>14
Land Preparation (lp)				
Surface Rock (%)	< 3	3 - 15	15 - 40	> 40
Rock Outcrops (%)	< 2	2 - 10	10 - 25	> 25

Source : Ritung *et al.*, (2011)

Eucalyptus grandis

Land Use Requirements/ Land Characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature(°C)	20 - 30	30 - 34	14 - 20	> 34 < 14
Water Availability(wa)				
Rainfall (mm)				
Dry Months	< 2	2 - 4	4 - 5	> 5
LGP				
Oxygen Availability (oa)				
Drainage	Well Drained, Somewhat Excessively Drained, Moderate	Moderate	Somewhat Poorly Drained	Poorly Drained, Excessively Drained, Very Poorly Drained
Rooting Media (rc)				
Texture	Somewhat coarse, Moderate, Somewhat fine	Coarse, Fine	Very fine	
Coarse Fragments (%)	-	-	-	-
Soil Depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)		< 100	100 - 200	> 200
Decomposition Level		Sapric	Hemic	Hemic, Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)				
Base Saturation (%)				
pH H ₂ O	5,5 - 7,0	7,0 - 7,5 5,0 - 5,5	7,5 - 8,0 4,5 - 5,0	> 8,0 < 4,5
Organic-C (%)				
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	
K ₂ O (mg/100 g)	Moderate	Low	Very Low	
Toxicity(xc)				
Salinity (dS/m)	< 4	4 - 6	6 - 8	> 8
Soodicity (xn)				
Alkalinity/ESP (%)				
Sulfidic hazard (xs)				
Sulfidic depth (cm)	> 125	100 - 125	75 - 100	< 75
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	Very Slight	Slight - Moderate	Severe	Very Severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	25	25-50	>50
- Duration (days)	-	<7	7-14	>14
Land Preparation (lp)				
Surface Rock (%)	< 3	3 - 15	15 - 40	> 40
Rock Outcrops (%)	< 2	2 - 10	10 - 25	> 25

Source : Ritung *et al.*, (2011)

Melaleuca (*Melaleuca leucadendron*)

Land Use Requirements/ Land Characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature(°C)	21 - 35	Td	Td	> 35 < 21
Water Availability(wa)				
Rainfall (mm)	1200 - 1600	> 1600 800 - 1200	< 800	
Dry Months	2 - 4	< 2	-	-
LGP				
Oxygen Availability (oa)				
Drainage	Very Poorly Drained	Poorly Drained	Somewhat Excessively Drained, Somewhat Poorly Drained	Excessively Drained, Very Excessively Drained
Rooting Media (rc)				
Texture	Moderate, Somewhat fine, Fine	Coarse, Somewhat coarse	-	
Coarse Fragments (%)	-	-	-	-
Soil Depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)		< 100	100 - 200	> 200
Decomposition Level		Sapric	Hemic	Hemic, Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)				
Base Saturation (%)				
pH H ₂ O	4,0 - 4,5	Td	Td	> 8,5
Organic-C (%)				
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	
K ₂ O (mg/100 g)	Moderate	Low	Very Low	
Toxicity(xc)				
Salinity (dS/m)	< 4	4 - 8	8 - 12	> 12
Soodicity (xn)				
Alkalinity/ESP (%)	-	-	-	-
Sulfidic hazard (xs)				
Sulfidic depth (cm)	> 125	75 - 125	< 75	< 75
Erosion Hazard (eh)				
Slope (%)	-	-	-	-
Erosion Hazard	-	-	-	-
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	25	25-50	>50
- Duration (days)	-	<7	7-14	>14
Land Preparation (lp)				
Surface Rock (%)	< 3	3 - 15	15 - 40	> 40
Rock Outcrops (%)	< 2	2 - 10	10 - 25	> 25

Source : Ritung *et al.*, (2011)

Pine (*Pinus merkusii*)

Land Use Requirements/ Land Characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature(°C)	19 - 21	21 - 23 17 - 19	-	> 23 < 17
Water Availability (wa)				
Rainfall (mm)	2500 - 3000	3000 - 4000 2000 - 2500	-	> 4000 < 2000
Dry Months	1 - 2	2 - 3 < 1	-	> 3
LGP				
Oxygen Availability (oa)				
Drainage	Well Drained	Moderate	Somewhat Poorly Drained, Somewhat Excessively Drained	Poorly Drained, Excessively Drained, Very Poorly Drained, Very Excessively Drained
Rooting Media (rc)				
Texture	Somewhat coarse, Moderate, Somewhat fine	Coarse, Fine	-	
Coarse Fragments (%)	-	-	-	-
Soil Depth (cm)	> 100	75 - 100	50 - 75	< 50
Peat:				
Thickness (cm)		< 100	100 - 200	> 200
Decomposition Level		Sapric	Hemic	Hemic, Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)				
Base Saturation (%)				
pH H ₂ O	5,5 - 7,0	7,0 - 8,0 4,5 - 5,5	-	> 8,0 < 4,5
Organic-C (%)				
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	
K ₂ O (mg/100 g)	Moderate	Low	Very Low	
Toxicity(xc)				
Salinity (dS/m)	< 2	2 - 4	4 - 6	> 6
Soodicity (xn)				
Alkalinity/ESP (%)				
Sulfidic hazard (xs)				
Sulfidic depth (cm)	> 125	100 - 125	75 - 100	< 75
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 40	> 40
Erosion Hazard	Very Slight	Slight - Moderate	Severe	Very Severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	25	25-50	>50
- Duration (days)	-	<7	7-14	>14
Land Preparation (lp)				
Surface Rock (%)	< 3	3 - 15	15 - 40	> 40
Rock Outcrops (%)	< 2	2 - 10	10 - 25	> 25

Source : Ritung *et al.*, (2011)

Cendana (*Santalum album L.*)

Land Use Requirements/ Land Characteristics	Land Suitability Class			
	S1	S2	S1	N
Temperature (tc)				
Average temperature(°C)	22,5 - 25	10 - 22,5 25-35	0 - 10 35-40	< 0 > 40
Water Availability				
Rainfall (mm)	1.100 - 1.350	600 - 1.100 1.350-1.600	500 - 600 1.600-3.000	< 500 > 3.000
Dry Month	< 65	65--75	75-85	>85
Humidity	30-55	25-30 55-65	10-25 65-75	<10 >75
Moisture content	>1,5	1,0-1,5	<1,0	-
Oxygen Availability (oa)				
Drainage	Good - Slightly good	Moderately fast	Rapidly restricted	Very rapidly restricted
Rooting Media (rc)				
Soil Texture	H,ah,s,ak	H,ah,s,ak	k	k
Coarse Fragment (%)	<15	15-35	35-55	>55
Effective depth (cm)	>50	40-50	30-40	<30
Peat:				
Thickness (cm)				
Maturity				
Nutrient Retention (nr)				
Soil CEC (cmol)				
Base Saturation (%)				
pH H ₂ O	7,0-8,0	6,5-7,0 8,0-8,5	5,5-6,5 8,5-9,0	
Bahan Organik (%)	>4,0	3,0-4,0	<3,0	
Organic-C (%)	>4,0	3,0-4,0	<3,0	
Total Nitrogen (%)	>4,0	0,3-0,4	<0,3	
P ₂ O ₅ (mg/100 g)	>80	40-80	<40	
P (ppm)	>4,0	20-40	<20	
K ₂ O (mg/100 g)	>1,0	0,75-1,0	<0,75	
Toxicity (xc)				
Salinity (dS/m)				
Sodisitas (xn)				
Alkalinity/ESP (%)				
Sulfidic hazard (xs)				
Depth to suldific layer cm)				
Erosion Hazard (eh)				
Slope (%)	<15	15-30	30-40	>40
Erosion Hazard	vl	l-m	h	vh
Flooding / waterlogging hazard during the cropping season (fh)				
- Depth (cm)				
- Duration (days)				
Land preparation (lp)				
Surface Rock Fragment	None	Moderate	Many	All
Rock Outcrop	None	Present	Few	Most

Sumber : (Troup,1921; Ramya, 2010; Neil, 1990; Sen-Sarma,1977)

Land Suitability Criteria

FORAGE CROPS

AND GRAZING



Elephantgrass (*Pennisetum purpureum* SCHUM.)

Land Use Requirements/ Land Characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	20 – 28	18 – 20 28 – 30	16 – 18 30 – 38	< 16 > 38
Water Availability (wa)				
Rainfall (mm)	1.700 – 2.000	1.400 – 1.700 2.000 – 3.000	1.100 – 1.400 3.000 – 5.000	< 1.100 > 5.000
Humidity (%)	< 65	65 – 75	75 – 85	< 85
Oxygen Availability (oa)				
Drainage	Well Drained, Somewhat Poorly Drained	Somewhat Excessively Drained, Moderate Drained	Poorly Drained	Very Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	Fine, Somewhat Fine, Moderate	Somewhat Coarse	Coarse, Very fine	Coarse
Coarse fragments (%)	< 15	15 – 35	35 – 55	> 55
Soil depth (cm)	> 50	> 50	30 – 50	< 30
Peat:				
Thickness (cm)	< 50	50 – 100	100 – 200	> 200
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 – 16	< 5	
Base saturation (%)	> 50	35 – 50	< 35	
pH H ₂ O	5,5 – 6,5	4,5 – 5,5 6,5 – 7,5	< 4,5 > 7,5	
Organic-C (%)	> 0,4	≤ 0,4		
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 – 6	6 – 8	> 8
Sodicity (xn)				
Alkalinity/ESP (%)	-	-	-	-
Sulfidic Hazard (xs)				
Sulfidic depth (cm)	> 100	75 – 100	40 – 75	< 40
Erosion Hazard (eh)				
Slope (%)	< 8	8 – 15	15 – 30	> 30
Erosion Hazard	Very Slight	Slight – Moderate	Severe	Very Severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	25	25-50	>50
- Duration (days)	-	<7	7-14	>14
Land Preparation (lp)				
Surface rock (%)	< 5	5 – 15	15 – 40	> 40
Rock outcrops (%)	< 5	5 – 15	15 – 25	> 25

Source: Ritung *et al.*, (2011)

Setaria (*Setaria spachelata*)

Land Use Requirements/ Land Characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	20 – 28	18 – 20 28 – 30	16 – 18 30 – 38	< 16 > 38
Water Availability (wa)				
Rainfall (mm)	1.200 – 2.000	1.000 – 1.200 2.000 – 3.000	700 – 1.000 3.000 – 5.000	< 700 > 5.000
Humidity (%)	< 65	65 – 75	75 – 85	< 85
Oxygen Availability (oa)				
Drainage	Well Drained, Somewhat Poorly Drained	Somewhat Excessively Drained, Moderate Drained	Poorly Drained	Very Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	Fine, Somewhat Fine, Moderate	Somewhat Coarse	Coarse, Very Fine	Coarse
Coarse fragments (%)	< 15	15 – 35	35 – 55	> 55
Soil depth (cm)	> 50	> 50	30 – 50	< 30
Peat:				
Thickness (cm)	< 50	50 – 100	100 – 200	> 200
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 – 16	< 5	
Base saturation (%)	> 50	35 – 50	< 35	
pH H ₂ O	5,8 – 7,0	5,5 – 5,8 7,0 – 7,5	< 5,5 > 7,5	
Organic-C (%)	> 0,4	≤ 0,4		
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 – 6	6 – 8	> 8
Sodicity (xn)				
Alkalinity/ESP (%)	-	-	-	-
Sulfidic Hazard (xs)				
Sulfidic depth (cm)	> 100	75 – 100	40 – 75	< 40
Erosion Hazard (eh)				
Slope (%)	< 8	8 – 16	16 – 30	> 30
Erosion Hazard	Very Low	Low – Moderate	Severe	Very Severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	25	25-50	>50
- Duration (days)	-	<7	7-14	>14
Land Preparation (lp)				
Surface rock (%)	< 5	5 – 15	15 – 40	> 40
Rock outcrops (%)	< 5	5 – 15	15 – 25	> 25

Source: Ritung *et al.*, (2011)

Legume Group

Land Use Requirements/ Land Characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average temperature (°C)	20 – 28	18 – 20 28 – 30	16 – 18 30 – 38	< 16 > 38
Water Availability (wa)				
Rainfall (mm)	1.500 – 2.000	900 – 1.500 2.000 – 2.500	600 – 900 2.500 – 3.000	< 600 > 3.000
Humidity (%)	< 65	65 – 75	75 – 85	< 85
Oxygen Availability (oa)				
Drainage	Well Drained, Somewhat Poorly Drained	Somewhat Excessively Drained, Moderate Drained	Poorly Drained	Very Poorly Drained, Excessively Drained
Rooting Media (rc)				
Texture	Fine, Somewhat Fine, Moderate	Somewhat Coarse	Coarse	Coarse
Coarse fragments (%)	< 15	15 – 35	35 – 55	> 55
Soil depth (cm)	> 75	50 – 75	40 – 50	< 40
Peat:				
Thickness (cm)	< 50	50 – 100	100 – 200	> 200
Decomposition level	Sapric	Sapric, Hemic	Hemic	Fibric
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 – 16	< 5	
Base saturation (%)	> 50	35 – 50	< 35	
pH H ₂ O	5,8 – 7,0	5,5 – 5,8 7,0 – 7,5	< 5,5 > 7,5	
Organic-C (%)	> 0,4	≤ 0,4		
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	-
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	-
K ₂ O (mg/100 g)	Moderate	Low	Very Low	-
Toxicity (xc)				
Salinity (dS/m)	< 4	4 – 6	6 – 8	> 8
Soodicity (xn)				
Alkalinity/ESP (%)	-	-	-	-
Sulfidic Hazard (xs)				
Sulfidic depth (cm)	> 100	75 – 100	40 – 75	< 40
Erosion Hazard (eh)				
Slope (%)	< 3	3 – 8	8 – 15	> 15
Erosion Hazard		Very Slight	Slight – Moderate	Severe – Very Severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	25	25-50	>50
- Duration (days)	-	<7	7-14	>14
Land Preparation (lp)				
Surface rock (%)	< 5	5 – 15	15 – 40	> 40
Rock outcrops (%)	< 5	5 – 15	15 – 25	> 25

Source: Ritung *et al.*, (2011)

Grazing (*Pasture*)

Land Use Requirements/ Land Characteristics	Land Suitability Class			
	S1	S2	S3	N
Temperature (tc)				
Average Temperature (°C)	20 - 30	30 - 35 18 - 20	35 - 40 12 - 18	> 40 < 12
Water Availability (wa)				
Dry Months	< 2	2 - 3	3 - 6	> 6
Annual Rainfall (mm)	1500 - 4000	4000 - 5000 1000 - 1500	5000 - 6000 400 - 1000	> 6000 < 400
LGP	> 330	300 - 330	180 - 300	< 180
Rooting Media (rc)				
Drainage	Somewhat Poorly Drained, Moderate Drained, Well Drained	Somewhat Excessively Drained, Poorly Drained	Very Poorly Drained, Excessively Drained	
Texture	Somewhat Coarse, Moderate, Somewhat Fine, Fine	Coarse, Very Fine	Coarse, Very Fine	
Coarse Fragments (%)	-	-	-	-
Soil Depth (cm)	> 30	20 - 30	15 - 20	< 15
Peat:				
Thickness (cm)				
Decomposition level				
Nutrient Retention (nr)				
Soil Cation Exchange Capacity (cmol)	> 16	5 - 16	< 5	-
Base saturation (%)				
pH H ₂ O	5,0 - 6,5	6,5 - 7,0 4,5 - 5,0	7,0 - 8,5 < 4,5	> 8,5 < 4,5
Organic-C (%)				
Available Nutrients (na)				
Total Nitrogen (%)	Moderate	Low	Very Low	
P ₂ O ₅ (mg/100 g)	Moderate	Low	Very Low	
K ₂ O (mg/100 g)	Moderate	Low	Very Low	
Toxicity (xc)				
Salinity (dS/m)	< 3	3 - 5	5 - 10	> 10
Soodicity (xn)				
Alkalinity/ESP (%)	-	-	-	-
Sulfidic Hazard (xs)				
Sulfidic depth (cm)	> 50	40 - 50	35 - 40	< 35
Erosion Hazard (eh)				
Slope (%)	< 8	8 - 15	15 - 30	> 30
Erosion Hazard	Very Low	Low	Moderate	Severe - Very Severe
Flooding/Inundation Hazard during planting period (fh)				
- Depth (cm)	-	25	25-50	>50
- Duration (days)	-	<7	7-14	>14
Land Preparation (lp)				
Surface rock (%)	< 3	3 - 15	15 - 40	> 40
Rock outcrops (%)	< 2	2 - 10	10 - 25	> 25

Source: Ritung *et al.*, (2011)

Land Suitability Criteria

FRESHWATER AND BRACKISHWATER AQUACULTURE



Nile Tilapia (*Oreochromis niloticus*)

Suitability requirements / parameters	Suitability class			
	S1	S2	S3	N
Topography				
Slope (%)	< 0,1	0,1-1,0	1,0-2,0	> 2,0
Soil Conditions				
Clay (%)	10-20	20-30	30-60	< 10 > 60
pHf-pHfox	< 1,5	1,5-3,5	3,5-6,0	> 6,0
Organic carbon	1,5-2,5	0,5-1,5	< 0,5 2,5-8,0	> 8,0
Water quality				
Temperature (°C)	28-30	20-28 30-35	12-20 35-40	< 12 > 40
Salinity (ppt)	< 10	10-25	25-35	> 35
pH	7,5-8,5	6,0-7,5 8,5-9,5	4,0-6,0 9,5-11,0	< 4,0 > 11,0
TDS (ppm)	<1000	1000-1500	1500-2000	>2000
Ammonia (mg/L)	< 0,3	0,3-0,4	0,4-0,5	> 0,5
DO (mg/L)	>5	4-5	3-<4	<3
Climate				
Annual rainfall (mm/tahun)	2.500-3.000	2.000-2.500	1.000-2.000 3.000-3.500	< 1.000 > 3.500
Dry months	1-2	2-3	3-5	< 1 > 5

Source: Mustafa (2012)

Common carp (*Cyprinus carpio*)

Suitability requirements / parameters	Suitability class			
	S1	S2	S3	N
Topography				
Slope (%)	< 0,1	0,1-1,0	1,0-2,0	> 2,0
Soil Conditions				
Clay (%)	10-20	20-30	30-60	< 10 > 60
pHf-pHfox	< 1,5	1,5-3,5	3,5-6,0	> 6,0
Organic carbon	1,5-2,5	0,5-1,5	< 0,5 2,5-8,0	> 8,0
Water quality				
Temperature (°C)	24-28	22-<24 28-30	20-<22 30-32	<20 >32
Salinity (ppt)	0-2	2-5	5-10	>10
pH	6,5-8,5	6-<6,5 8,5-9	5,5-<6 9-9,5	<5,5 >9,5
TDS (ppm)	<1000	1000-1500	1500-2000	>2000
Ammonia (mg/L)	<0.05	0.05-0.1	0.1-0.5	>0.5
DO (mg/L)	>5	4-5	3-<4	<3
Climate				
Annual rainfall (mm/tahun)	2.500-3.000	2.000-2.500	1.000-2.000 3.000-3.500	< 1.000 > 3.500
Dry months	1-2	2-3	3-5	< 1 > 5

Source : Mustafa (2012)

Giant gourami (*Ospronemus gouramy*)

Suitability requirements / parameters	Suitability class			
	S1	S2	S3	N
Topography				
Slope (%)	< 0,1	0,1-1,0	1,0-2,0	> 2,0
Soil Conditions				
Clay (%)	10-20	20-30	30-60	< 10 > 60
pHf-pHfox	< 1,5	1,5-3,5	3,5-6,0	> 6,0
Organic carbon	1,5-2,5	0,5-1,5	< 0,5 2,5-8,0	> 8,0
Water quality				
Temperature (°C)	29-30	24-28	22-23 31-32	<22 >33
Salinity (ppt)	0	0.1-0.5	0.6-1	>1
pH	7-7,5	6,5-7 dan 7,5-8	6-6,5 8-8,5	<6,5 >8,5
TDS (ppm)	0-1000	1001-2000	2001-3000	>3001
Ammonia (mg/L)	<0,1	>0,1-0,3	>0,3-0,4	>0,4
DO (mg/L)	4-9	3	2	<2
Climate				
Annual rainfall (mm/tahun)	2.500-3.000	2.000-2.500	1.000-2.000 3.000-3.500	< 1.000 > 3.500
Dry months	1-2	2-3	3-5	< 1 > 5

Source : Mustafa (2012), Nurhidayah dkk (2024)

Catfish (*Clarias batrachus*)

Suitability requirements / parameters	Suitability class			
	S1	S2	S3	N
Topography				
Slope (%)	< 0,1	0,1-1,0	1,0-2,0	> 2,0
Soil Conditions				
Clay (%)	10-20	20-30	30-60	< 10 > 60
pHf-pHfox	< 1,5	1,5-3,5	3,5-6,0	> 6,0
Organic carbon	1,5-2,5	0,5-1,5	< 0,5 2,5-8,0	> 8,0
Water quality				
Temperature (°C)	25-30	23-<25 30-32	21-<23 32-34	<21 >34
Salinity (ppt)	0-2	2-5	5-10	>10
pH	6.5-8.5	6-<6.5 8.5-9	5.5-<6 9-9.5	<5.5 >9.5
TDS (ppm)	<1500	1500-2000	2000-2500	>2500
Ammonia (mg/L)	<0.1	0.1-0.5	0.5-1	>1
DO (mg/L)	>4	3-4	2-<3	<2
Climate				
Annual rainfall (mm/tahun)	2.500-3.000	2.000-2.500	1.000-2.000 3.000-3.500	< 1.000 > 3.500
Dry months	1-2	2-3	3-5	< 1 > 5

Source : Mustafa (2012)

Milkfish (*Chanos chanos*)

Suitability requirements / parameters	Suitability class			
	S1	S2	S3	N
Topography				
Slope (%)	< 0,1	0,1-1,0	1,0-2,0	> 2,0
Soil Conditions				
Clay (%)	10-20	20-30	30-60	< 10 > 60
pHf-pHfox	< 1,0	1,0-3,0	3,0-5,0	> 5,0
Organic carbon	1,5-2,5	0,5-1,5	< 0,5 2,5-8,0	> 8,0
Water quality				
Temperature (°C)	28-30	20-28 30-35	12-20 35-40	< 12 > 40
Salinity (ppt)	15-20	10-15 20-30	< 10 30-50	> 50
pH	7,5-8,5	6,0-7,5 8,5-9,5	4,0-6,0 9,5-11,0	< 4,0 > 11,0
TDS (ppm)	<1500	1500-2000	2000-3000	>3000
Ammonia (mg/L)	< 0,1	0,1-0,2	0,2-0,3	> 0,3
DO (mg/L)	>4	3-4	2-<3	<2
Climate				
Annual rainfall (mm/tahun)	2.500-3.000	2.000-2.500	1.000-2.000 3.000-3.500	< 1.000 > 3.500
Dry months	1-2	2-3	3-5	< 1 > 5

Source : Mustafa (2012)

Mud crab (*Scylla serrata*)

Suitability requirements / parameters	Suitability class			
	S1	S2	S3	N
Topography				
Slope (%)	< 0,1	0,1-2,0	2,0-8,0	> 8,0
Soil Conditions				
Clay (%)	10-20	20-30	30-60	< 10 > 60
pHf-pHfox	< 1,5	1,5-3,5	3,5-6,0	> 6,0
Organic carbon	1,5-2,5	0,5-1,5	< 0,5 2,5-8,0	> 8,0
Water quality				
Temperature (°C)	28-30	20-28 30-35	12-20 35-40	< 12 > 40
Salinity (ppt)	15-25	10-<15 25-30	5-<10 30-35	<5 >35
pH	7-8,5	6,5-7 8,5-9	6-6,5 9-9,5	<6 >9,5
TDS (ppm)	<1000	1000-1500	1500-2000	>2000
Ammonia (mg/L)	< 0,3	0,3-0,4	0,4-0,5	> 0,5
DO (mg/L)	>5	4-5	3-<4	<3
Climate				
Annual rainfall (mm/tahun)	1000-1.500	1.500-3.000	3.000-3.500	< 1.000 > 3.500
Dry months	1-2	2-3	3-5	< 1 > 5

Source : Mustafa (2012), Triyanto (2012)

Whiteleg shrimp (*Litopenaeus vannamei*)

Suitability requirements / parameters	Suitability class			
	S1	S2	S3	N
Topography				
Slope (%)	< 0,1	0,1-1,0	1,0-2,0	> 2,0
Soil Conditions				
Clay (%)	10-20	20-30	30-60	< 10 > 60
pHf-pHfox	< 0,5	0,5-1,5	1,5-4,0	> 4,0
Organic carbon	1,5-2,5	0,5-1,5	< 0,5 2,5-8,0	> 8,0
Water quality				
Temperature (°C)	28-30	20-28 30-35	12-20 35-40	< 12 > 40
Salinity (ppt)	15-20	10-15 20-30	< 10 30-50	> 50
pH	7,5-8,5	6,0-7,5 8,5-9,5	4,0-6,0 9,5-11,0	< 4,0 > 11,0
TDS (ppm)	<2000	2000-3000	3000-4000	>4000
Ammonia (mg/L)	<0.1	0.1-0.25	0.25-0.5	>0.5
DO (mg/L)	>5	4-5	3-<4	<3
Climate				
Annual rainfall (mm/tahun)	2.500-3.000	2.000-2.500	1.000-2.000 3.000-3.500	< 1.000 > 3.500
Dry months	1-2	2-3	3-5	< 1 > 5

Source : Mustafa (2012)

Brackish Water Fisheries

Land Use Requirements/ Land Characteristics	Land Suitability Class			
	S1	S2	S3	N
Topography				
Slope (%)	< 1	< 1	1 - 2	> 2
Elevation (m asl)	1 - 2	1 - 2	1 - 2	> 2
Climate				
Annual Rainfall (mm)	2000 - 2500	1500 - 2000 2500 - 3000	1000 - 1500 3000 - 3500	< 1000 > 3500
Average number of dry months (months)	1 - 2	3 - 4	5 - 6	> 6
Number of rainy days (days)	135 - 170	135 - 170		< 135 > 170
Water Source				
Brackish Water Availability	10 - 12	7 - 9	4 - 7	< 4
pH	7,0 - 8,5	7,0 - 8,5	6,0 - 7,0	< 6,0 > 8,5
Salinity (‰)	15 - 25	15 - 25	10 - 15 30 - 45	< 10 > 45
Water Transparency (cm)	30	30	25	< 25
Tides				
- Amplitude (m)	1 - 2	1 - 2		< 1
- Annual amplitude (m)	< 3	< 3	< 3	> 3
Freshwater source	Permanent	Permanent	Semi-Permanent	Slight
Soil				
Texture	Fine	Somewhat Fine	Moderate	Coarse, Somewhat coarse
Soil Maturity	Mature	Nearly Mature	Partly Mature	Almost Raw
Organic Matter (%)	3,5 - 7,0	3,5 - 7,0	7,0 - 10,0	> 10
C/N Ratio	11 - 16	11 - 16	< 11 16 - 30	> 30
pH	7,5 - 8,3	6,5 - 7,5 8,3 - 8,5	5,5 - 6,5	< 5,5 > 8,5
Pyrite			< 1,2	> 1,2
Available P ₂ O ₅	Moderate - High	Moderate	Low	Very Low
Flood hazard (frequency/month)	Without	Without	1 - 2	> 2

Source: Ritung *et al.*, (2011)

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Education: B.Sc. in Animal Science (Udayana University); M.Sc. in Reproductive Biology, Graduate School (IPB University); Ph.D. in Animal Science (Udayana University).

Teaching Experience: 2002–present.

Areas of Expertise: Livestock reproductive biology; reproductive and production management; science-based strengthening of livestock systems; improvement of livestock production performance.



I Wayan Darya Kartika, S.Pi., M.Si.

Education: B.Sc. in Fisheries Product Technology (IPB University); M.Sc. in Fisheries Product Technology, Graduate Program (IPB University).

Teaching Experience: 2018–present.

Areas of Expertise: Fisheries product technology (processing and quality assurance); post-harvest handling; product development; value addition for fisheries commodities.

B. Researchers from MAPPF, Timor-Leste



Eng. Celestino Luis Moreira, MP

Areas of Expertise: Land suitability assessment; soil classification; regional potential mapping.

Role/Responsibilities: Technical coordinator for field operations and program development for regional potential mapping and land suitability evaluation in Timor-Leste (2024/2025).



Eng. Cesar Jose da Cruz, PG-GSRNA

Areas of Expertise: Research management; field supervision; monitoring and quality assurance of field observations.

Role/Responsibilities: Research Director responsible for strategic guidance and for ensuring that field observations are implemented in accordance with the work plan and methodological standards.



Eng. Nilton J.A. de Carvalho Ribeiro, M.Sc

Areas of Expertise: Geographic Information Systems (GIS); spatial database management; integration of spatial and attribute datasets.

Role/Responsibilities: GIS and database technician responsible for database preparation, updating, and management, and for providing technical support for analysis, mapping, and reporting.

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