

# *Evaluation of Land Suitability for Banggai Sweet Potato (*Dioscorea Alata*) in Peling Tengah District, Banggai Islands*

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**Abstract**— The sweet potato plant is a type of local food, tubers that are very popular in the Peling Tengah community, Banggai Islands Regency, and are an alternative type of plant for the main food ingredient after rice. For this reason, knowledge of land evaluation is needed so that optimal and sustainable agricultural production can be achieved. This research was conducted in October 2021 - January 2022, in Peling Tengah District, Banggai Islands Regency. The research method used is survey, analysis, and land suitability classification based on the following criteria: requirements for plant growth in accordance with the characteristics/quality of the land. The results showed that the actual land suitability class was S3 (marginal), with limiting factors including: rainfall, temperature, slope, drainage, texture, soil CEC, pH, N-Total, P2O5, K2O, erosion hazard, base saturation, and C Organic

**Keywords** – Land Evaluation, Land Suitability, Banggai Sweet Potato, Land Characteristics

## I. INTRODUCTION

The process of determining whether a piece of land is suitable for a certain use involves utilizing a tried-and-true method or methodology. The outcome takes the shape of guidelines and details about how to use the land properly in accordance with the physical characteristics of the land. In order to determine and aid in a comparison of the various possible land uses that can be applied to a variety of specific use options, surveys, interpretations, and studies of landforms, soils, vegetation, climate, and other aspects of the land are conducted as part of the land evaluation process. A selection of different commodities that are suitable for development in a region can be made on the basis of the diversity of soil qualities, geography, and climate [1]. Survey results Rahmatu et al., (2001) found 11 species of sweet potato belonging to the family *Dioscorea* sp which can be consumed with different colors and shapes and has a good taste. The proud sweet potato found in Bangkep has three different colors including white, yellow, and purple. The three colors (piqmen) are thought to contain natural anti oxidants which are very good for health, from these 3 types can produce tubers with an average of  $10 \pm 30$  tons/ha. Most of the population in Peling Tengah District, Banggai Islands Regency has a livelihood in the agricultural sector, with the food crop sub-sector, (BPP Peling Tengah, 2020). Banggai sweet potato is one of the genetic resources of root crops and a local specific food source that has been cultivated by the indigenous people of the Banggai Islands for generations. The Banggai yam commodity can be an alternative food source as a substitute for rice and even become the main food source for the indigenous people of the Banggai Islands. The development of the proud yam is still at a stage where the harvest of the proud yam has not yet become a product that has added value. In addition, the economic, social, and environmental conditions of the Central Peling District are low, and the direction of commodity development has not been well directed. Sustainability of land resources will be greatly

influenced by predictions based on land suitability for various types of production inputs and required management with implications for environmental changes. On land that is exploited without considering soil conservation methods, these effects can include possible soil damage through erosion [2].

According to some experts, "evaluation" is an activity that involves testing, making decisions, and systematically assigning values to objects. It is also noted that measurement and comparison are necessary for the evaluation process. Both qualitative and quantitative measurements can be made. When measuring qualitatively, the condition can be described using terms like "good," "poor," "appropriate," "inappropriate," "high," "low," and so on. Abstract conditions are revealed via qualitative analysis. However, because the outcomes may be expressed as specific numbers or values, quantitative examination can offer a clearer picture [3]. *Dioscorea* species, also known as sweet potatoes, have enormous promise as rice-complementary food crops. The government's policy on food diversification and Sulawesi's shrinking amount of arable land will offer fantastic chances for the growth of this crop. The sweet potato is a food crop that grows in Banggai Regency, Central Sulawesi, and is one of the agricultural products that can be characterized as endemic (locally specific). The yam plant may be cultivated as one of the key commodities for extra food other than rice because it is not only endemic but has long been the staple food consumed by the local population. The population growth of Banggai Islands Regency is accompanied by a shrinking agricultural land area, where the use of agricultural land for food crops as residential areas, industry and other infrastructure, the cultivation system is carried out by the community with a shifting cultivation pattern resulting in a decrease in agricultural land [4]. The ability of a region to solve the problems faced ultimately determines the goals to be achieved. So that in overcoming a problem that arises due to the problem of the welfare gap, it is necessary to carry out planned development efforts. So as to be able to provide positive changes to the problems faced [5].

The qualities or characteristics of the land are typically considered while determining whether or not the land is suitable for a certain use. The completeness of the land itself can be measured or assessed by factors like rainfall, soil type, and water availability. A more complicated soil feature known as land quality includes factors including the appropriateness of soil moisture, moisture resistance to erosion, and flood resistance [6]. An methodology or procedure that has been tried and tested is used to evaluate the land resources that can be obtained for a given purpose. The outcomes of the land appraisal will offer details or usage instructions as needed. Land damage will come from use that is out of line with the land's capabilities. Land destruction will also negatively affect the community's social, cultural, and economic issues. This has happened in Mesopotamia and Babylon, for instance, along the Euphrates and Tigris. In order to structure land use planning, land evaluation is done well. Knowing the potential and suitability of the land for multiple uses in advance is essential for effective land use planning [7]. Land characteristics are measurable or estimable aspects of a certain piece of land. For instance, slope, precipitation, soil type, water storage capacity, effective depth, and so forth. Land features, such as the physical state of the environment and soil, are documented and detailed for each unit of land map derived through survey and/or mapping of land resources. The information is utilized for land interpretation and commodity appraisal.

In evaluating land use, land usage must be connected to the kind of land use (Land Utilization Type) comprises management, necessary inputs, and specified expected outcomes, it is the type of land use that is discussed in more detail. Land use types are subdivided into each sort of land use. Because it pertains to features of input, technology, and output, land use type refers to specific land uses whose level is below the general land use category rather than a categorical level of land use classification. Data and/or assumptions relating to yield, market orientation, capital intensity, labor, energy resources, understanding of land use technology, infrastructure demands, size and type of land tenure, land ownership, and income level per capita are examples of land use characteristics [8]. The agricultural intensification program to meet the growing demand for food production and efforts to improve economic welfare has the potential to damage soil, water and biodiversity globally [9]. This makes us increasingly aware that land use decisions have economic, environmental, social and cultural impacts beyond agriculture [10]. Information that can help is needed to understand the implications of land use in various desired outcomes, on the other hand information on land capabilities and land suitability classes for various crops is still limited. Availability of information on land capability and land suitability must be preceded by the availability of data on climate and land characteristics [11].

Exploring and analyzing the Banggai sweet potato variety in various regions to obtain various collections of local superior variants can be one strategy to maintain the sustainability of this sweet potato variety. The kinship between Banggai sweet potato varieties based on phenotypic characteristics can be studied to provide basic information for the purposes of

further studies related to the breeding of Banggai sweet potato varieties and related studies. This is a straightforward way to preserve Banggai sweet potatoes as one of the potentials to be developed as an alternative food source [12]. For further development of the Banggai sweet potato in Peling Tengah District, a system is needed to assess the potential of the existing land using the land suitability evaluation method. With this method, various characteristics of the land used and land management actions are needed in the framework of productivity and land conservation. The purpose of land evaluation is to predict all possible consequences if there is a change in land use [13]. With the evaluation of land suitability, it is hoped that data on land characteristics will show the properties of the land so that the level of land suitability can be known, especially for paddy fields and dry land. Then, efforts are made in accordance with the characteristics of the land which will ultimately optimize crop production [14].

## II. RESEARCH METHODS

This research was conducted in October 2021 - January 2022, in Peling Tengah District, Banggai Islands Regency. The total area of the Peling Tengah District is 140 km<sup>2</sup>, which consists of 11 villages. The research area was carried out in villages where sweet potato is a food crop commodity that dominates and is a supplier of economic growth in the area of Peling Tengah sub-district, namely Tunggaling Village, Patutuki Village, and Tolulos Village. Administratively, the research location is located at: latitude 1°28'32.99" S and longitude 123°12'9.40" E. The tools used are GPS, Belgian soil drill, Muncel Soil Color Book. The materials used are soil samples taken in a composite manner and chemicals used for soil analysis in the Laboratory of Soil Chemistry and Soil Fertility Laboratory, Department of Soil Science, Faculty of Agriculture, Hasanuddin University Makassar.

The stages of research implementation include:

1. Preparation, namely collecting secondary data in the form of topographic maps, administrative maps, soil types and their use as well as climate data
2. Conducting interviews with farmers about the previous land as research material
3. Visually see the research area
4. Create and determine observation points in the field
5. Taking coordinates at the research location
6. Determine the color of the soil using the Muncel Soil Color Book
7. Taking samples to be sent to the Laboratory of Soil Chemistry and Soil Fertility, Department of Soil Science, Faculty of Agriculture, Hasanuddin University, Makassar.

The data obtained is processed and presented in the form of local and image. Furthermore, the data were analyzed descriptively and quantitatively and interpreted according to the research objectives. Land suitability analysis is based on the land evaluation framework (FAO, 1976), and land suitability criteria (Djenudin et al, 2011), while taking into account local conditions in the field. Following are the stages of land suitability assessment:

1. Determination of Land Use Type. The type of land use (TPL) in this study is based on agricultural food commodities that have high economic value for the development of food ocaltor agriculture in Peling Tengah District, Banggai Islands Regency. The type of TPL is based on agricultural crops which have great opportunities for agricultural business based on food crops. Land use is divided based on the area and height of the land to be studied according to the research method.
2. Determination of Land Suitability Class. Land Suitability Class is determined based on the Land Index value. Land index was determined based on land quality which was calculated using the following square root land index method (Sys et al., 1991):

Information:

I = Land Index

rmin = Minimum ratingland quality

A,B = Ratingland quality other than the minimum land quality rating

Table 1 Land Suitability Class Based on Land IndexClass

Land index	Land suitability class	Description
100-75	S1	Sangat sesuai
75-50	S2	Agak sesuai
50-25	S3	Sesuai marginal
0-25	N	Tidak sesuai

Source: Balai Penelitian Tanah dan World Agroforestry Centre (ICRAF), Bogor, Indonesia (2007).

### III. RESULT AND DISCUSSION

Soil texture in Banggai Islands is a type of soil in the form of sandy loam which is suitable for growing tubers, this is in accordance with what was stated by Ritung et al, (2011) that the soils are medium textured (dusty loam), rather fine (clay loam,) classified as a very suitable class for Ubi to be proud of. The condition of the Banggai Kepulauan agroecosystem is dominant with dry land. These conditions are very supportive of the development of germplasm accession of local food plants that have unique properties in responding to extreme environmental changes.

Table 2. Land suitability for Banggai sweet potato in Tunggaling Village

Land Quality and characteristics	Data Value	Land suitability Class
Temperature and average temperature of water availability	31 °C	S1
Rainfall	1,673 mm	S2
Media Roots depth of Soil	> 100 cm	S1
Soil Drainase	Baik	S1
Texture	Lempung	S1
Nutrient retention KTK	14,15	S2
C-Organic	0,63%	S3
Language saturation	29	S2
pH	5,42	S2
nutrients available P2O5	9,03	S2
N-Total	0,11	S2
Land Suitability		S3

Source: Analysis Data (2020).

The information in the table demonstrates that the study site has a high level of C-organic soil. Additionally, the results of the suitability class matching show that the research area is categorized as a very suitable class for activities involving the growing of Banggai sweet potatoes. When considering the growing conditions for tuber cultivation, the texture of dusty clay is particularly favorable for its development. Physically, soil texture has a significant role in determining soil quality, particularly in terms of holding water on the land of the two villages. As a result, it is rated as high and denotes that

the ground does not become sodden after a rainstorm. This is a result of the soil's character, which includes dusty loamy and loamy soils, resulting in good aeration and rapid organic matter decomposition. High organic matter is said to promote root nutrient uptake and boost porosity and water availability in soils with a dusty clay texture.

Low levels of total P and K were found in the soil at the research site. The parent materials used to create the soil in the research area, lime and marl, have considerably more calcium than other soils. explains that orthophosphate ions in soil solutions can be firmly bonded, which prevents plant roots from absorbing P ions, interfering with processes like respiration and photosynthesis. The low phosphorus nutrient in both fields was initially assumed to be caused by the phosphorus' simple loss and poor soil phosphorus content. Additionally, the addition of P. fertilizer might raise the amount of accessible P in the soil. One of the chemical characteristics of soil that is directly related to the availability of nutrients for plants and serves as a measure of soil fertility is cation exchange capacity. The soil in Matanga and Bentean Villages has a high soil colloid content, which is reflected by the predominant clay texture, giving the land there an estimated CEC value. The clay CEC value can be used to identify the comparatively large amounts of clay minerals that are present. Other researchers who studied soils that originated from the same geological formation reported experiencing comparable situations. Despite the mild status, it is necessary to raise the soil CEC at the study site to prevent nutrient leakage, particularly of those that are highly mobile, and to lessen the likelihood of erosion. The improvement of organic matter as a contributor to organic colloids with variable load/depending on pH can be used to carry out these efforts. Additionally, the research location has a medium base saturation (KB) content percentage. In part because plants can get basic cations in good condition. This can be used to show that Ca and Mg cations are the likely bases that are the main contributors to the value of base saturation at the research site. These two cations are cations that the soil dissolution process released into the soil solution.

Table 3. Land Suitability of Banggai Sweet Potato Plantation in Tolulos Village

Land Quality and Caharacteristics	Data Value	Land suitability Class
Temperature and average temperature of water availability	31 °C	S1
Rainfall	1,673 mm	S2
Media Roots depth of Soil	> 100 cm	S1
Soil Drainase	Baik	S1
Texture	Berdebu	S1
Nutrient retention KTK	14,15	S2
C-Organic	0,47%	S3
Language saturation	24	S2
pH	5,35	S2
nutrients available P2O5	7,94	S2
N-Total	0,08	S3
Land Suitability		S3fN

Based on Tables 2 and 3, the results of land suitability assessment for Banggai sweet potato in Tunggaling and Patutuki villages, Peling Tengah sub-district, are included in the marginal land suitability class with the limiting factor C-Organic (S3f), while for Tolulos Village the land suitability is included in the marginal land suitability class. with the limiting factor of C-Organic and total N (S3fn). The success of cultivating a plant, be it sweet potato or other agricultural or plantation crops, is

largely determined by soil fertility. Soil is a growth medium for higher plants and a living base for animals and humans [15]. Soil productivity for plant growth is based on the physical and chemical properties of the soil as organic soil fertility [16].

The limiting factor of C-Organic can be improved by adding organic matter. Soil organic matter is one of the soil enhancers that has felt its benefits in improving soil properties, both physical, chemical and biological properties of the soil. Physically improve soil structure, determine the level of development of soil structure and play a role in the formation of soil aggregates (Rajiman et al, 2008). Improvements can also be made by liming or adding organic matter to the soil. Soil organic matter plays an important role in increasing and maintaining the chemical, physical and biological fertility of the soil, which will determine crop productivity and sustainable use of land for agriculture (Ding et al, 2002). Agusni et al, (2014) explained that soil that has porous organic matter will increase soil pores.

Efforts to improve the limiting factor of nutrient availability (N total) with fertilization steps. Plant growth and development is strongly influenced by the application of fertilizers and the availability of nutrients in the soil. Thus the lowest nutrient status will control the plant growth process. To achieve optimal growth, all nutrients must be in a balanced state, meaning that no single nutrient should be a limiting factor (Pahan, 2008). Fertilizing N, P, K to maintain the ability of the soil to provide these elements for plants.

#### **IV. CONCLUSION**

The results of the land suitability analysis of Banggai sweet potato in Peling Tengah District, Banggai Islands Regency, concluded that the land suitability class in Tunggaling village and Patutuki village was classified as marginal according to the limiting factor of C - Organic (S3f). For the village of Tolulos, land suitability is classified as marginal according to land suitability with limiting factors of C-Organic and Total N content (S3fn). The amount of organic matter in the soil has a significant impact on the soil's capacity to maintain soil fertility through soil microbial activity and humus in the study site soil. Given that soil organic matter is crucial to establishing soil fertility, organic matter must be added to the soil. Organic matter is also crucial for the development of stable soil aggregates and plays a part in the granulation of the soil.

#### **V. ACKNOWLEDGMENT**

Based on the existing research, it is recommended that additional study be conducted on the cultivation of Sweet Potato Banggai (*Dioscorea* spp.) with various varieties at various places in the Palu valley using a combination of inorganic, organic, and mulch fertilizers.

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