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ANALYSIS OF SOIL FERTILITY STATUS ON AGRICULTURAL LAND IN WEST SINJAI DISTRICT

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Abstrak

Status kesuburan tanah tidak hanya menggambarkan jenis unsur hara melainkan juga kandungan unsur hara pada tanah. Status kesuburan tanah yang dimanfaatkan pada sektor pertanian memiliki banyak variasi dan dipengaruhi oleh pengelolaan tanah. Pengelolaan tanah mennetukan tumbuh kembang tanaman dan produktivitasnya. Kabupaten Sinjai memiliki 9 kecamatan secara administratif dan tiga diantaranya ditetapkan sebagai kawasan agropolitan, salah satunya adalah Kecamatan Sinjai Barat. Kecamatan ini dianggap sangat berpotensi untuk pengembangan sektor pertanian karena letak geografisnya yang berada pada daerah ketinggian. Produktivitas lahan pertanian sangat ditentukan oleh kualitas tanah yang ada yang tercermin dari kelas status kesuburannya. Untuk itu, tanah yang ada perlu dievaluasi status kesuburannya, agar pemberian masukan (input) dapat sesuai dengan kebutuhan tanah. Metode yang digunakan pada penelitian ini adalah metode survei dan analisis laboratorium untuk mendapatkan hasil dari parameter kesuburan tanah berupa KTK, P_2O_5, kejenuhan basa (KB), K_2O, dan C- organik yang kemudian dilakukan analisis deskriptif. Berdasarkan parameter kesuburan tanah yang telah dianalisis, diperoleh status kesuburan tanah pada masing-masing lokasi berada pada kelas status rendah. Hal ini dipengaruhi oleh nilai dari parameter KTK, P_2O_5, kejenuhan basa (KB), K_2O, dan C- organik.

***Kata kunci**: Kesuburan Tanah, Analisis Tanah, Pertanian, Sinjai Barat*

Abstract

Soil fertility status not only depicts types of nutrients but also the available nutrients content in the soil. Soil fertility status that is used in agriculture has wide variations and influenced by soil management. Soil management determines of plant growth and its productivity. Three from nine districts in Sinjai Regency are designated as agropolitan areas, one of which is West Sinjai District. This district is considered to be very potential for development of agricultural sector because geographically it is located on high latitude area. The productivity of agricultural land is largely determined by the existing soil quality, which is reflected in its fertility status. Therefore, the existing soil needs to be evaluated for its fertility status, thus the input can be in accordance with the needs of the soil. The method used in this research are survey method, laboratory analysis to obtain result from soil fertility parameters in the form of KTK parameters, KB, P_2O_5, K_2O, and C-organic which is then carried out descriptive analysis. The results showed that the soil fertility status at each location is in low. This is influenced by the parameter values of the KTK parameters, KB, P_2O_5, K_2O, and C-organic.

***Key words**: Soil fertility, soil analysis, agriculture, West Sinjai*

INTRODUCTION

Plant growing media that is often used intensively is soil. Intense use of land over a long period of time can lead to degradation of soil properties which results in low soil fertility status (Zainudin & Kesumaningwati, 2021). The level of soil fertility is characterized by the depth of the soil profile (more than 150 cm), the friability of the structure, the pH with a value of 6.0-6.5, the adequacy of nutrients available

to plants, and the absence of limiting factors for plant growth (Prabowo & Subantoro, 2017). The process of soil formation is caused by factors such as soil parent material, climate, topography/relief, organisms and time (Rahmi & Biantary, 2014). The level of soil fertility is strongly influenced by the physical characteristics, biology and chemical components of the soil which is the implication of the differences in soil-forming factors.

Soil fertility does not only describe the types of nutrients contained in the soil but also the content of existing nutrients (Baja, S. et al., 2007). One of the factors that can reduce crop yields is the lack of nutrients in the soil. Therefore, to add nutrients can be obtained by fertilization (Puja et al., 2015). The value of soil fertility used for the agricultural sector varies widely. An important factor to determine plant growth and results is proper soil management because it is one of the factors that affect plant growth (Sartohadi, J. et al., 2014). The studied soil fertility is a way to assess nutrient problems in the soil and to provide information on fertilizer recommendations (Pinatih et al., 2016).

South Sulawesi Province is known by one of the national food granary provinces. It has many regencies whose majority of the population is engaged in the agricultural sector, both as rice farmers and farmers of horticultural crops. Sinjai Regency is one of the regencies that supports the agricultural sector.

Sinjai Regency (Figure 1) has 9 districts administratively and three of them are designated as agropolitan areas, one of which is West Sinjai District. This district is considered to be very potential for the development of the agricultural sector because of its geographical location which is at an high altitude (Ahmad Hidayat, 2021)

Therefore, an increase in crop productivity is highly expected from agricultural land in the West Sinjai District. The productivity of agricultural land is strongly influenced by the quality of the existing soil which is reflected in its level fertility status. The analysis soil fertility status needs to be done so that the input can be in accordance with the needs of the soil. According to PPT (1983), soil fertility parameters can be seen from the variety of soil chemical characters, such as the value of Cation Exchange Capacity (CEC), Base Saturation (BS), the value of organic matter, phosphorus until value of potassium in the soil.

RESEARCH METHODS

The research area is in West Sinjai District, Sinjai Regency with an area of 135.53 km^2, astronomically located at 5° 6' 54" – 5° 21' 00" South and 119° 55' 43" – 120° 5' 00 West. This study uses a survey method that uses laboratory analysis and descriptive analysis.

There are two data used in this study i.e. primary data was from the result of field surveys and laboratory analysis of soil samples. Secondary data were obtained from relevant government agencies and several other references. The equipment used in this research include: Global Positioning System (GPS), Abney level, ring sample, and ground drill. The materials used are: administrative map of Sinjai Regency, administrative map of West Sinjai District, map of soil types, land use map, elevation map, rainfall data, and soil samples.

The procedure for taking soil samples was taken based on land units (Figure 2) which was carried out by purposive sampling method. Soil samples were taken using a ring sample with a diameter of 5 cm at a depth of 0-50 cm. Soil chemical properties consisting of cation exchange capacity (CEC), base saturation (BS), C-organic, P_2O_5, dan K_2O were analyzed in the laboratory to assess soil fertility status.

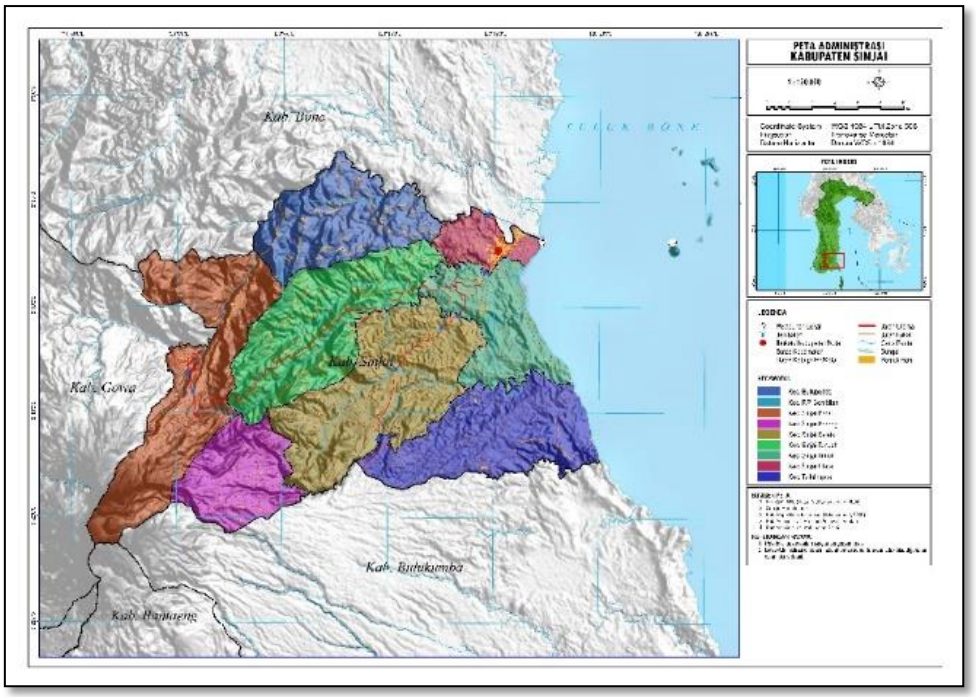

Figure 1. Sinjai Regency Map

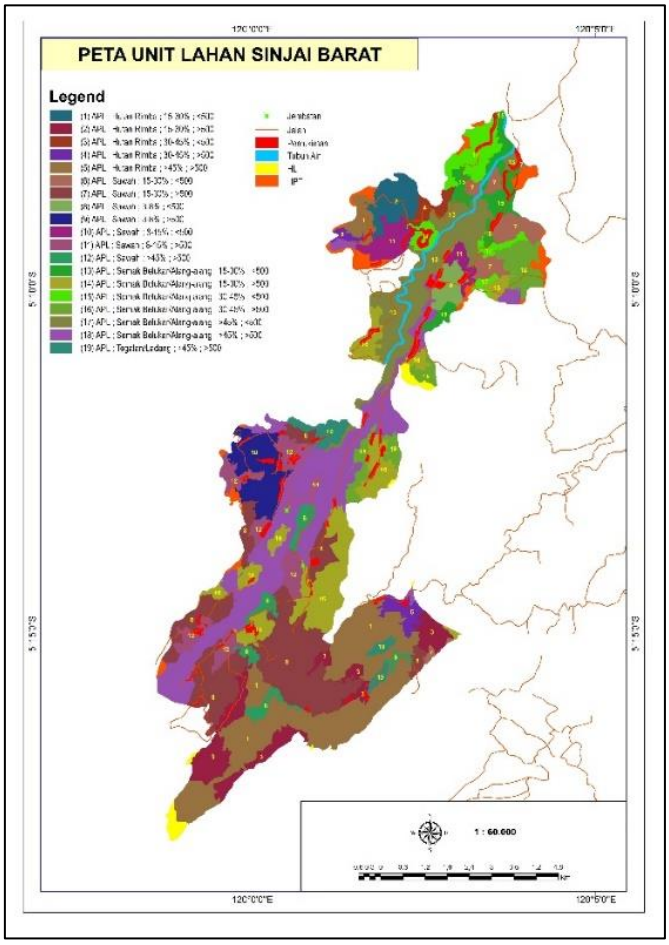

Figure 2. Land Unit Map

Determination of soil fertility status is guided by the soil fertility index determined by the Soil Research Center (PPT, 1995) with several combinations or combinations of soil

properties, namely CEC, BS, P2O5, K2O and C-organic (Table 1).

Furthermore, the results of the laboratory analysis were analyzed descriptively based on a literature review to determine the factors that limit soil fertility and management actions that need to be taken to reduce the limitation factors. The determined fertility limitation factor can represent the total number of soil samples based on the parameters tested to assess the low (L) and very low (VR) status in the study area. The level of the limitation factors for soil fertility status can be seen in Table 2.

RESULTS AND DISCUSSION

Heading

Soil Texture

The soil in research area is still dominated by clay particles, followed by dust and then sand. These results can be seen in the percentage of soil texture that has been analyzed. Therefore, the soil texture class in seven land units are included in the dusty clay, two land units are clay, and another one is sandy clay (Table 3).

Table 1. *Soil Chemical Properties Assessment Criteria*

No	Parameters	Very Low	Low	Medium	High	Very High
1	C-organik	< 1	1 - 2	2,01 - 3	3 - 5	> 5
2	KB (%)	< 20	20 - 35	36 - 50	51 - 70	> 70
3	P_2O_5 (%)	< 10	10 - 20	21 - 40	41 - 60	> 60
4	K_2O (%)	< 10	10 - 20	21 - 40	41 - 60	> 60
5	KTK (me/100 g)	< 5	5 - 15	16 - 24	25 - 40	> 40

Source: Petunjuk Teknis Evaluasi Kesuburan Tanah, PPT (1995)

Table 2. *Criteria of Soil Fertility Status*

No	CEC	BS	P_2O_5, K_2O, C-organic	Soil Fertility Status
1	H	H	2H without L	High
2	H	H	2H with L	Medium
3	H	H	2M without L	High
4	H	H	2M with L	Medium
5	H	H	HVL	Medium
6	H	H	2L with H	Medium
7	H	M	2L with M	Low
8	H	M	2H without L	High
9	H	M	2H with L	Medium
10	H	M	2M without L	Medium
11	H	M	Other combinations	Low
12	H	L	2H without L	Medium
13	H	L	2H with L	Low
14	H	L	Other combinations	Low
15	M	H	2H without L	Medium
16	M	H	2H with L	Medium
17	M	H	Other combinations	Low
18	M	M	2H without L	Medium
19	M	M	2H with L	Medium
20	M	M	Other combinations	Low
21	M	L	3H	Medium
22	M	L	Other combinations	Low
23	L	H	2H without L	Medium
24	L	H	2H with L	Low
25	L	H	2M without L	Medium
26	L	H	Other combinations	Low
27	L	M	2H without L	Medium
28	L	M	Other combinations	Low
29	L	L	All combination	Low
30	VL	HVL	All combination	Very Low

Description: H=High; M=Medium; L=Low; VL=Very Low

Table 3. *Soil Texture*

Land Unit	Location (Sub-district)	Texture			
		Sand (%)	Dust (%)	Clay (%)	Texture Class
LU 1	Terasa	22	39	39	Dusty clay
LU 2	Gunung Perak	12	41	47	Dusty clay
LU 3	Turungan Baji	3	45	52	Dusty clay
LU 4	Gunung Perak	13	44	43	Dusty clay
LU 5	Turungan Baji	6	44	51	Dusty clay
LU 6	Kelurahan Tassiliu	14	43	43	Dusty clay
LU 7	Terasa	60	20	20	Sandy clay
LU 8	Arabika	16	47	37	Dusty clay
LU 9	Turungan Baji	16	31	53	Clay
LU 10	Arabika	10	35	55	Clay

Source: Laboratory analysis

Soil pH

Other soil chemical properties that also determine the availability of nutrients and various other soil properties such as the dominant micro-organisms found in the soil and the speed of the process of overhauling organic matter is soil pH. Based on laboratory analysis, the results of soil pH at each sampling location were in the range of 6.2 to 6.6, which can be seen in detail in Table 4.

Table 4. *Soil pH*

Land Unit	Location (Sub-district)	pH
LU 1	Terasa	6,3
LU 2	Gunung Perak	6,2
LU 3	Turungan Baji	6,4
LU 4	Gunung Perak	6,4
LU 5	Turungan Baji	6,6
LU 6	Kelurahan Tassiliu	6,5
LU 7	Terasa	6,5
LU 8	Arabika	6,5
LU 9	Turungan Baji	6,3
LU 10	Arabika	6,4

Source: Laboratory analysis

Cation Exchange Capacity (CEC)

Soil CEC for each sample point is in the range of 19.09 to 24.84 (medium class). CEC is a chemical property of soil that is closely related to soil fertility status. If the soil has a high CEC, it will be able to accommodate and provide better nutrients than the soil with a low CEC value. Low soil fertility status can occur if the CEC is dominated by acid cations, Al, and H (low base saturation), while soil fertility values can increase if alkaline cations dominate as well as Ca, Mg, K, Na (high base saturation).

Base Saturation (BS)

Base saturation is the ratio between base cations and CEC. Soil pH and climate (air humidity) affect the base saturation of the soil. One indicator of soil chemical fertility is base saturation. The high value of base saturation is directly proportional to soil fertility because soil leaching has not occurred effectively. On the other hand, if soil leaching has occurred intensively, it will result in low base saturation and indicate that the soil is acidic which has an impact on inhibiting the absorption of nutrients by plant roots. Base saturation indicates that the land in each location is in the range of 40 - 56% which belongs to the medium to high criteria. Increased base saturation can have an impact on the content of basic cations in the soil which is very beneficial for plants and the availability of nutrient retention.

Phosphorus (P_2O_5)

Based on data analysis, it is known that the P_2O_5 content at the study site has a value between 19.13 mg/100 g to 28.87 mg/100 g which is in the low and medium class.

Potassium (K_2O)

Analysis of the potassium value at each sampling location showed that the potassium value was in the range of 8.11 mg/100 g to 17.07 mg/100 g which are including in the very low to low class.

C-Organic

Organic matter in the soil has a very significant role to increase soil productivity because soil fertility can be increased and maintained in the presence of organic matter. The physical properties of the existing soil such as pore aeration, aggregate stability and water retention can be improved. Likewise, the chemical properties of the soil (supply of nutrients, CEC and organic C), as well as the biology of the soil which makes up the body of soil microorganisms and energy sources can be improved with the availability of organic matter. Soil samples that have been taken have C-organic content ranging from 1.47 to 2.43% or are in the low to medium criteria class.

Table 5. *Soil Chemical Properties*

Land Unit	Location (Sub-district)	CEC (me/100g)	BS (%)	P_2O_5 (mg/100g)	K_2O (mg/100g)	C-organic
LU 1	Terasa	20,44	53	28,87	9,36	2,43
LU 2	Gunung Perak	20,48	41	21,30	12,98	1,99
LU 3	Turungan Baji	22,25	46	26,91	17,07	1,98
LU 4	Gunung Perak	22,14	63	23,83	8,11	1,98
LU 5	Turungan Baji	19,55	47	24,87	11,75	1,80
LU 6	Kelurahan Tassiliu	22,82	56	19,13	14,42	1,47
LU 7	Terasa	19,09	45	22,13	13,42	1,51
LU 8	Arabika	24,84	54	22,76	15,70	1,56
LU 9	Turungan Baji	24,44	40	23,28	15,59	1,75
LU 10	Arabika	24,35	41	20,78	14,00	1,80

Source: Laboratory analysis

Soil Fertility Status

Based on the parameters of soil fertility that have been analyzed, the soil fertility status in each location is in a low class. This is influenced by the value of CEC, base saturation (BS), P_2O_5, K_2O, dan C- organic which can be seen in Table 5. Soil fertility status is in the low class because the parameters are dominantly in the low and medium class for all land unit (Table 6).

Table 6. *Soil Fertility Status*

Land Unit	Location (Sub-district)	CEC (me/100g)	BS (%)	P_2O_5 (mg/100g)	K_2O (mg/100g)	C-organic	Fertility Status
LU 1	Terasa	M	H	M	VL	M	Low
LU 2	Gunung Perak	M	M	M	L	L	Low
LU 3	Turungan Baji	M	M	M	L	L	Low
LU 4	Gunung Perak	M	H	M	VL	L	Low
LU 5	Turungan Baji	M	M	M	L	L	Low
LU 6	Kelurahan Tassiliu	M	H	L	L	L	Low
LU 7	Terasa	M	M	M	L	L	Low
LU 8	Arabika	M	H	M	L	L	Low
LU 9	Turungan Baji	M	M	M	L	L	Low
LU 10	Arabika	M	M	L	L	L	Low

Description: H= High; M= Medium; L=Low; VL= Very Low
Source: Analysis result, 2022

CONCLUSION

Soil fertility status in West Sinjai District is low, based on the results of soil analysis and determined by the soil fertility index method. Limitation factors of soil fertility, namely the CEC is in medium class, base saturation (BS) which is partly in medium status, P_2O_5 is in medium and low class, K_2O is in low and very low class, and C-organic is belong to low class.

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