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Status Of Soil Fertility In Palm Oil Plantation Areas In Logas Village Kecamatan Singingi Kabupaten Kuantan Singingi

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Abstract

Oil palm (Elaeis guineensis Jacq) is a plantation crop commodity that is the main choice for farmers in Kabupaten Kuantan Singing, Logas village is a village in Kecamatan Singing where most of the people are oil palm farmers. Soil fertility is the main factor that affects the production of oil palm plants. This study aims to determine the status of soil fertility in the area of smallholder oil palm plantations in Logas village, Singingi sub-district, Kabupaten Kuantan Singingi. The research method was carried out by means of a survey by taking soil samples on oil palm plants aged 3, 5 and 7 years by purposive sampling. The results showed the value of Cation Exchange Capacity (CEC) of the soil ranged from 1.11 me/100 g (very low)-3.13 me/100 g (very low), Base Saturation (KB) between 106% (very high)-322% (very high), P2O5 levels ranged from 5.05 ppm (very low)- 52.2 ppm (high), K2O as much as 4.96 ppm (very low)- 16.2 ppm (low), and organic C content between 0.56 (very low)-1.16% (low). From these data, the status of the in the community oil palm plantation area in Logas village is very low.
Keywords: *Oil palm, soil fertility, Kuantan Singingi, Logas*

Introduction

Oil palm is a leading commodity in the plantation sub-sector for farmers in Kabupaten Kuantan Singingi, the majority of farmers switched to oil palm crops who were originally rubber farmers, in the last 10 years there has been an increase in the area of oil palm plantations which mostly come from rubber plantations and ex-mining land.

Based on data from the Central Bureau of Statistics (BPS) of Kabupaten Kuantan Singingi in 2023, the area of oil palm plantations in 2022 was 221,520 hectares. Most of the oil palm plantations in Kabupaten Kuantan Singingi are dominated by smallholder plantations, where the cultivation and maintenance process has not met the standards, especially in soil management, so that crop production does not reach maximum results.

According to Mandala et al. (2021) to maximize oil palm production, the fertilization method must refer to the seven right, namely the right type, dose, time, method, placement, formulation form, and rotation. the availability of nutrients in the soil by fertilizing must be balanced, which is adjusted to the needs of the plant.

Logas Village is one of the villages in Singingi District, Kabupaten Kuantan Singingi. The results of research by Pailis et al. (2022) showed that most of the people in Logas village work as farmers, especially oil palm.

Oil palm cultivation techniques carried out by farmers have not been implemented in the right way, especially in the use of fertilizers. Generally, farmers use inorganic fertilizers to meet plant nutrient needs, with doses and types that are not in accordance with standards, so that plants cannot grow optimally. To determine the nutritional needs of the soil, it is necessary to know the status of soil fertility before fertilization, so that the fertilizer given is in accordance with the type and needs of the soil. In addition, the age of the plants will also affect soil fertility. Soil that is used continuously for crop cultivation, if not given fertilizer on an ongoing basis will result in soil poor in organic matter, this condition will reduce soil fertility.

Based on the above problems, it is necessary to identify soil fertility, so that oil palm cultivation activities can have a positive impact on plant growth, and nutrients in the soil become available with land management can provide good fertilization recommendations according to plant needs.

METHODS

The research was conducted in Logas village, namely in oil palm plantations aged 3,5 and 7 years. The research was conducted by survey with purposive sampling technique. Soil was taken at a depth of 0-20 cm using a drill, each location consisted of 3 sample points, at each point drilling was carried out at 5 points, then the soil was composited, then 500 g was taken to be dried and sieved, then analyzed at the Central Plantation

Laboratory Pekanbaru. The research was conducted in March-April 2025.

The implementation of the research began with a survey of the research site, soil sampling, soil drying, sieving, and laboratory analysis. The parameters observed were Cation Exchange Capacity (CEC), Base Saturation (KB), P2O5 content (available phosphorus), K2O content, and organic C amount. To determine the status of soil fertility, the assessment criteria set by the Soil Research Center in 1995 were compared.

Table 1. Soil Chemical Properties Assessment Criteria

Soil properties	Very low	Low	Medium	High	Very High
C (%)	< 1,0	1,00-2,00	2,01-3,00	3,01-5,00	>5,00
N (%)	< 0,10	0,10-0.20	0,21-0,50	0,51-0,75	> 0,75
P_2O_5(ppm)	< 10	10-25	26-45	46- 60	> 60
K_2O (ppm)	< 10	10-25	26-45	47- 60	> 60
CEC (me/100 g)	<5	5 -16	17- 24	25- 40	> 40
SB (%)	< 20	20-35	18-36-50	26-51-70	> 70

Source: Soil Research Center (1995

RESULTS AND DISCUSSION

1. Cation Exchange Capacity Values

Results of observations of soil CEC values at 3 locations in oil palm plantations in Logas village ranged from 1.11 me/100 g (very low) -3.13 me/100 g (very low). The data in Table 2 are the results of soil CEC analysis. The highest CEC value is found in the 3-year-old plantation area (3.13 me/100 g), and the lowest in the 5-year-old plantation (1.11 me/100 g), but overall the CEC value is categorized as very low because it is less than 5 me/100 g. The low CEC value can be caused by the low CEC value in the plantation area. The low CEC value can be caused by the soil texture which is partly dominated by sand, so it has a weak binding capacity to nutrients in the soil.

The CEC value is strongly influenced by the amount of organic matter in the soil, soil that has high organic matter will have a high CEC value, otherwise if the soil lacks organic matter it will have a low CEC value.

Table 2. Data of Soil CEC Analysis

No	Plant age	CEC	Criteria
1	3	3,13	Very Low
2	5	1,11	Very Low
3	7	2,08	Very Low
Average		2,11	Very Low

According to Widyantari et al. (2015) the CEC value is influenced by the organic C value. Soil organic matter contributes a negative charge that is able to exchange cations in the soil so as to increase the cation exchange capacity of the soil. The CEC value in disturbed soil is usually lower than undisturbed soil, the decrease in CEC value can be caused by the decrease in organic matter due to physical damage. The oil palm land in Logas village is former gold mining land, where the top soil layer has been eroded and some of it is sand, this also results in a lack of organic matter, so the CEC value is very low.

2. Base Saturation Value

Base saturation is the percentage of the total cation exchange capacity (CEC) occupied by base cations such as potassium (K), calcium (Ca), magnesium (Mg), and sodium (Na). Some factors that affect soil base saturation include soil type, organic matter content, soil pH, and weather conditions, especially high rainfall which can cause leaching of base cations. Table 3 shows the results of the analysis of soil base saturation (KB) in the oil palm plantation area in Logas village.

Table 3. Data of Base Saturation Analysis

No	Plant age	base saturation	Criteria
1	3	322	Very High
2	5	106	Very High
3	7	183	Very High
Average		203	Very High

The results of soil KB analysis in oil palm plantation areas in Logas village ranged from 106%-322% with very high criteria (>70%). The high KB value is caused by the low clay content in the soil, because the soil in the oil palm plantation area in Logas village is dominated by sand, besides that the nutrient content in the soil is very low, this can be seen from the very low CEC value.

3. P2O5 content (ppm)

The P_2O_5 analysis data in Table 4 shows that the available P content of the soil in oil palm plantations ranges from 13.7 ppm to 52.2 ppm. The highest available P content was found in the 3-year old plantation and the lowest in the 5-year old plantation. This is due to the fertilization techniques used by farmers, in the 3-year old plantation farmers provide organic fertilizer in the form of buffalo manure to oil palm plants, while the 5 and 7-year old

plantations do not provide organic material. This causes a very high difference in available P in the soil.

Table 4. Data of P_2O_5 Analysis

No	Plant age	P_2O_5	Criteria
1	3	52,2	High
2	5	5,05	Very Low
3	7	13,7	Low
Average		23,6	Low

The main factor that causes low soil P_2O_5 is caused by low organic matter in the soil, and vice versa if organic matter is high in the soil, P-availability will also be high. As stated by Atriyanti et al. (2023) that the P_2O_5 content in the soil is strongly influenced by organic matter and minerals in the soil. Researchers conducted by Okalia et al. (2020) showed that the high or low P-available soil is influenced by soil pH, the higher the soil pH, the higher the available P content of the soil

4. K_2O content (ppm)

The data from the analysis of soil K2O in oil palm land in Logas village ranged from 4.96 ppm (very low) to 16.5 ppm (low). The data in Table 5 are the results of the analysis of potassium content in the soil.

Table 5. K2O Analysis Data

No	Plant age	K_2O	Criteria
1	3	16,5	Low
2	5	4,96	Very Low
3	7	9,94	Very Low
Average		10,36	Low

Potassium content in the soil is influenced by the soil CEC value. According to Listianto et al. (2023) Low CEC indicates low soil surface area. This results in the ability of the soil to hold K being low, so that the soil solution easily releases K and increases the potential for leaching, resulting in a decrease in K in the soil.

Soil K2O content is one of the essential elements that can determine the level of soil fertility. The higher the K2O content, the higher the soil fertility level. Conversely, if the K2O content is low, the fertility level will also be low.

5. **C-Organic Content (%)**

The results of the C-Organic analysis of the soil in the oil palm plantation area of Logas village showed that the highest organic C content was in the 3-year-old plantation (1.16%) with low criteria and the lowest was in the 5-year-old plantation (0.56) with very low criteria.

Tabel 6. C-Organic analysis result data

No	Plant Age	C-org	Criteria
1	3	1,16	Low
2	5	0,56	Very Low
3	7	1,13	Low
Average		0,95	Very Low

The low content of soil organic C indicates that the land lacks organic matter, so it is necessary to fertilize using organic fertilizers to meet the needs of cultivated plants, if low C-organic content on a land will affect plant growth. According to Guillaume et al. (2016) as the age of oil palm plants increases, the amount of C-organic in the soil will decrease.

When viewed physically, the type of soil in Logas village is sandy soil type. Sandy soil has a low water binding ability, so it is unable to absorb nutrients given to the soil. According to Mandala et al. (2021) on sandy land or on post-mining land, the addition of organic matter is very necessary so that the availability of water in the soil can be retained and can be used by plants.

6. Soil Fertility Status

Based on the criteria for soil chemical analysis that has been carried out, to determine the fertility status is guided by the soil fertility standards set by the Soil Research Center in 1995, based on these standards, the soil status in the community oil palm plantation area in Logas village is in Table 7.

Tabel 7. Soil Fertility Status in Oil Palm

No	Plant age	CEC	BS	P_2O_5	K_2O	C-Organic	Status
1	3	VL	VH	H	L	L	V L
2	5	VL	VH	VL	VL	VL	V L
3	7	VL	VH	L	VL	L	V L

Description: VL: Very Low, L: Low, M: Medium, H: High, VH: Very Hihg

Plantation Areas in Logas Village

The status of soil fertility in Logas village is very low, both in 3-, 5- and 7-year-old plantations. This shows that there is a need for efforts to restore soil fertility, especially the addition of organic matter as a first step to restore soil conditions. Organic matter can be in the form of the use of organic fertilizers, where organic fertilizers can improve the biological, chemical and physical properties of the soil.

According to Harahap et al. (2025) the main limiting factor that causes the low level of soil fertility is the lack of organic matter, to increase soil fertility it is necessary to liming and adding organic matter so that the availability of nutrients in the soil is fulfilled.

CONCLUSION

Based on the Cation Exchange Capacity (CEC) value of the soil ranged from 1.11 me/100 g (very low)-3.13 me/100 g (very low), Base Saturation (KB) between 106% (very high)-322%

(very high), P2O5 levels ranged from 5.05 ppm (very low)- 52.2 ppm (high), K2O as much as 4.96 ppm (very low)- 16.2 ppm (low), and organic C content between 0.56 (very low)-1.16% (low). From these data, the soil fertility status in the community oil palm plantation area in Logas village is very low.

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