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Controlling Peat Soil Degradation In Oil Palm Plantations With Applications *Mucuna Bracteata* In Pt. Jatimjaya Perkasa

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ABSTRACT

Peatland degradation occurs because of the activities carried out on the land. This study aims to determine the effectiveness of Mucuna bracteata in controlling peat soil degradation in oil palm plantations and the effect of Mucuna bracteata age on peat soil degradation in oil palm plantations. This research was conducted by the survey method. The determination of the research location is done by a purposive sampling method. The type of location is peatland planted with oil palm and applied with Lagume Cover Crop Mucuna bracteata (LCC MB) without LCC MB aged 3, 4, and 5 years. Each location was studied with four replications. The soil physical properties and soil chemical properties (pH, C-organic, N-total, P-available, K-total, CaO, ash content, electrical conductivity, and redox potential) were measured. Peatland planted with oil palm and LCC MB applied was able to control the degradation of physical properties (air holding capacity and volume of weight) and chemical properties (ash content, N-total, P-available, K-total pH, and CaO) compared to those not applied. LCC MB. Peatland planted with oil palm and applied to LCC MB until the age of 3 years was able to control the chemical properties (P-available and K-total), but further increases in the age of LCC MB (4 and 5 years) were no longer effective in controlling the properties of the peat soil. Peatland planted with oil palm and applied to LCC MB was able to control the chemical properties (electrical conductivity and ash content), up to the age of 4 years, but a further increase in the age of LCC MB (5 years) was no longer effective in controlling the properties of the peat soil because it no longer experienced intensive growth.
Keywords: Degradation, Mucuna bracteata, Oil Palm Plantation, Peat soil,

1. INTRODUCTION

Peat has production functions, water storage, biodiversity habitat, protection, and economic functions. Harmonization between these various functions requires governance that utilizes appropriate and environmentally friendly technology to maintain the existence of peatland ecosystems so that they can meet human needs in a sustainable manner (Masganti and Anda, 2016).

Oil palm plantations in Indonesia have long been opened. On the East Coast and in North Sumatra, hundreds of thousands of hectares of oil palm plantations have been developed by farmers and corporations since 100 years ago until now. Oil palm farmers on these peatlands have even entered the second or third generation and have produced many graduates from palm oil income (gapki.id, 2016).

The area of oil palm plantations in Riau in 2015 was 2,400,876 ha, in 2016 it was 2,012,951 ha, in 2017 it was 2,703,199 ha, in 2018 it was 2,739,571 ha, and in 2019 it was 2,806,349 ha (Directoral General Plantation, 2020). Today, the role of peatlands in producing palm oil is becoming increasingly important in line with the increasing demand for edible oil and biodiesel, both for the domestic market and the international market. Demand for palm oil is growing rapidly, and the palm oil industry has responded by increasing production through area expansion, including on peatlands (Agus *et al*., 2016).

Degradation is the process of decreasing land productivity, both temporary and permanent, characterized by a decrease in physical, chemical, and biological properties (Wahyunto, 2018). Soil as a natural resource, if it has been degraded, means its quality has decreased, and in a broad sense, it is said to have decreased productivity (Utomo et al., 2016).

BBSDLP has classified peatlands based on depth, maturity, and land cover, into degraded and non-degraded peatlands. Degraded peatland is peatland that has experienced a decrease in its hydrological, production, and ecological functions caused by human activities. One of the signs of peatland degradation is the decrease in the surface of the peat soil. This can happen because the peat undergoes compression and subsidence, or the loss of peat mass due to the decomposition process. As a reference, natural peat swamp forest or still in the form of primary swamp forest is classified as non-degraded peatland. Degraded peatlands are generally overgrown by thickets or ferns due to neglect (Wahyunto et al., 2016).

In the practice of oil palm plantation activities, there are plants as land cover. Mucuna bracteata is a ground cover plant that grows vines. This plant is also widely used in oil palm and rubber plantations in Indonesia because it has high biomass when compared to other ground covers such as Centrocema pubesces and others (Siagian, 2003).

According to Harist (2017),the availability of sufficient water and soil temperature on peat soil overgrown with Mucuna bracteata will affect the population and activity of soil biota. The higher the soil water content, the lower the soil temperature and the more soil biota. The abundance of soil macrofauna and soil mesofauna will cause the decomposition process of organic matter from Mucuna bracteata to be more optimal, thereby increasing the nutrient content in the soil. From several sources above, it is stated that the planting of Mucuna bracteata is able to optimize microclimate conditions on the soil surface. The effectiveness of soil microclimate improvement in Mucuna bracteata planting is not yet known for its effectiveness in controlling peat soil degradation. In addition, is there any effect of the age of Mucuna bracteata on controlling peat soil degradation?

2. RESEARH METHOD

2.1. Place and time of research

The research was carried out in the area of PT. Jatim Jaya Perkasa Pedamaran Village, Bangko District, Rokan Hilir Regency and the soil laboratory, Faculty of Agriculture, Riau University, Bina Widya Campus, Pekanbaru. This research was carried out for 4 months, which took place from February 15to May 15, 2020.

2.2. Tools and Materials

The equipment used in this research was a map (a map of the earth, land use, and administration), GPS, compass, peat drill, meter, ring sampler, ring sampler handle, knife, shovel, and stationery.

2.3. Research Method

This research was conducted by the survey method. The determination of the research location was done by a purposive sampling method. The type of location was peatland planted with oil palm and applied Lagume Cover Crop Mucuna bracteata (LCC MB) without LCC MB aged 3, 4, and 5 years. Each research location was repeated four times.

The determination of land degradation class was done by the limiting factor method with the matching technique. Determination of peat soil degradation is carried out using a comparative method, namely by comparing the characteristics of the land with the damage criteria in Government Regulation number 150 of 2000, sourced from Wahyunto (2018).

2.4. Research Implementation

The research implementation included the following: a description of the research location, measurement of peat thickness, measurement of shallow water depth, soil sampling, analysis of physical properties, analysis of chemical properties, and data processing.

2.4.1. Research Site Description

The description of the research location includes rainfall, number of rainy days, temperature, humidity, duration of sunshine, maximum wind speed, location coordinates, topography, and altitude. Rainfall, the number of rainy days, and location coordinates are obtained directly from PT Jatimjaya Perkasa. Data on temperature, humidity, duration of sunlight, and maximum wind speed were obtained from the BMKG (2020) Meteorological Station Sultan Syarif Kasim II. Meanwhile, the topography and elevation of the location are obtained from the downstream profile book.

2.4.2. Peat Soil Thickness Measurement

Peat thickness measurements were carried out using a peat drill. The peat drill is plugged into the mineral soil, and then the boundary of the peat soil surface is marked. The peat drill is rotated clockwise to pick up the boundaries between the peat and mineral soil and then pulled out. The boundary between mineral soil and the peat soil surface is measured using a meter.

2.4.3. Shallow Water Depth Measurement

Shallow water depth measurements were measured by inserting a piezometer into the peat thickness measurement hole. After that, the boundary of the ground surface is marked. The groundwater limit is measured up to the ground level of the wood.

2.4.4. Soil Sampling

The method of taking soil samples is based on the technical instructions of the Center for Research and Development of Agricultural Land Resources. In this study, there were two types of soil samples, namely the type of undisturbed soil sample (intact) and the type of disturbed soil sample.

2.4.5. Physical Properties of Peat Soil Analysis

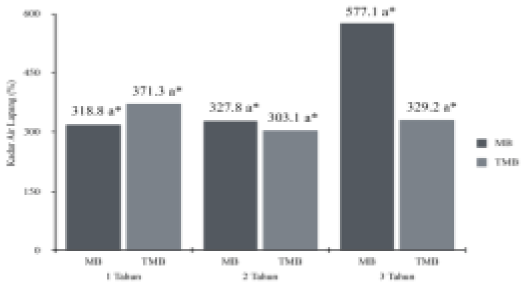


Figure 4.1 Field moisture content (%) on peatland without and planted with Mucuna bracteata

The physical properties of peat soil observed were field moisture content and volume weight, using soil samples with the method of taking undisturbed soil (intact soil).

3.4.6. Analysis of Peat Soil Chemical Properties

Analysis of the chemical properties of peat soil using soil samples disturbed by the soil sampling method. Soil samples on oil palm plantations with the same management were taken at five points and then composited. The chemical properties of peat soil in this study were pH, C-organic, N-total, P-available, K-total, CaO, ash content, electrical conductivity, and redox potential.

3. RESULT AND DISCUSSION

4.2.1 Physical Characteristics

The physical properties of the peat soil in this study were the field water content and volume weight. Observation of soil samples for physical properties was carried out on the land with Mucuna bracteata and without Mucuna bracteata.

1. Moisture Content of the Field

The results of field water content analysis showed that the land planted with Mucuna bracteata at the age of 3 years had the highest field water content. The land planted with Mucuna bracteata at the ages of 1 and 2 years has increased. The results of DMRT analysis at 5% level showed that the field water content on land without and planted with Mucuna bracteata at the age of 3 years was significantly different. The results of the field water content analysis are presented in Figure 4.1.

As can be seen on Figure 4.1, It can be stated that the peatland planted with oil palm and LCC MB was applied to have a field water content that was not different from that which was not applied to LCC MB. However, peatland planted with oil palm and applied to LCC MB at the age of 3 years had a higher field water content than that which was not applied to LCC MB.

2. Weight in Volume

The result of soil volume weight analysis showed that peatland planted with oil palm and LCC MB applied had no different BV compared to that without LCC MB application. On peatland planted with oil palm and LCC, MB applied at 2 and 4 years old, the soil volume was higher than that without LCC MB application. The results of the DNMRT further test at the 5% level are presented in Figure 4.3

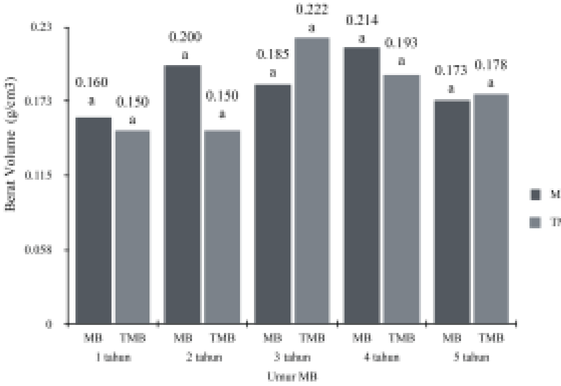


Figure 4.3 Volume weight on peatland without and planted with Mucuna bracteata

Bulk Density, or often referred to as volume weight is a physical property of soil that shows the weight of solid mass in a certain volume. Volume weight or BD was generally expressed in units of g.cm-3, kg dm-3, or t m-3. BD is the most frequently analyzed soil physical property, because it can be used as an initial description of other soil physical properties such as porosity, bearing capacity, and water-holding potential. Soil with a relatively low BD value generally has a high porosity, so the potential for absorbing and distributing water is high, but if the BD value is too low, the soil has a low bearing capacity.

4.2.2 Soil Chemical Properties

The chemical properties of peat soil in this study were pH, C-organic, N-total, P-available, K-total, CaO, ash content, electrical conductivity, and redox potential. Observation of chemical properties was carried out on peatland planted with oil palm and LCC MB was applied with and without LCC MB application.

1. Soil pH

The results of the analysis of variance showed that the pH of the peatlands planted with oil palm with LCC MB application and without LCC MB application at 1, 2, and 3 years old did not differ. However, at the age of 1, 2, and 3 years, the pH of the peatland planted with oil palm and LCC MB was applied was higher than without LCC MB application. The results of the further test of DNMRT at the 5% level of soil pH are presented in Figure 4.4.

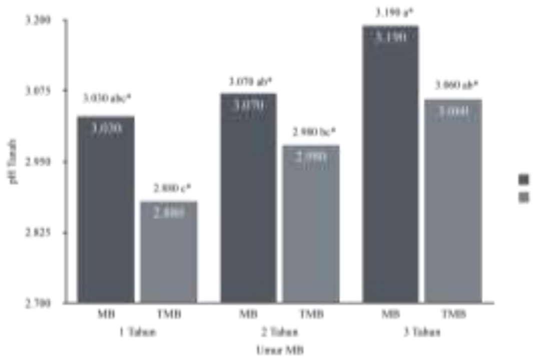


Figure 4.4.pH of peat soil planted with oil palm and LCC MB applied and without LCC MB application aged 1, 2, and 3 years.
Description : *Source : Lupitasari (2018)

The results of the analysis of variance showed that the pH of the peatlands planted with oil palm with LCC MB application and without LCC MB application at the age of 4 years was significantly different. However, at the age of 3 and 5 years, the pH of peatland planted with oil palm with LCC MB application and without LCC MB application was not significantly different. The results of the further test of DNMRT at the 5% level of soil pH are presented in Figure 4.5.

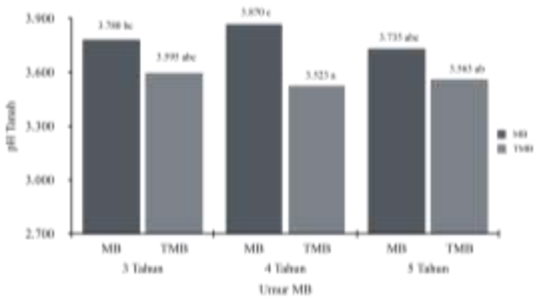


Figure 4.5. pH of peat soil planted with oil palm and LCC MB applied and without LCC MB application aged 3, 4, and 5 years

1. C-Organic Soil

The results of the analysis of variance showed that the organic C-organic peatland planted with oil palm with LCC MB application and without LCC MB application at the age of 5 years was significantly different. At the age of 1, 2, 3, and 4 years, the organic C-organic peatland planted with oil palm and LCC MB applied, and without LCC MB application was no different. The results of the further test of

DNMRT at the 5% level of soil pH are presented in Figure 4.6.

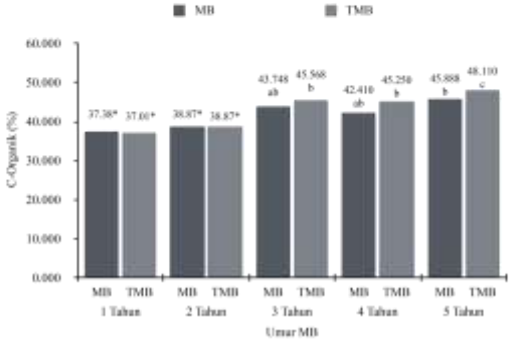
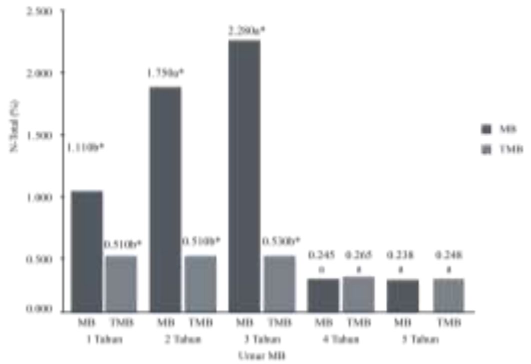


Figure 4.6. C-organic soil on peatland planted with oil palm and applied to LCC MB and without application of LCC MB aged 3, 4, and 5 years
Description : *Source : Lupitasari (2018)

At the age of 1 year, the C-organic soil on peatland planted with oil palm and LCC MB was applied and the C-organic soil was higher than without the LCC MB application. At the age of 2 years, C-organic soil on peatland planted with oil palm and LCC MB was applied the same as without LCC MB application. At the age of 3, 4, and 5 years, the soil organic C-organic on peatland planted with oil palm and LCC MB application was lower than without LCC MB application.

1. N-Total Soil

The results of the analysis of variance showed that the N-total of peatland planted with oil palm with LCC MB application and without LCC MB application at 2 and 3 years of age were significantly different. At the age of 1, 2, and 3 years, the N-total of peatland planted with oil palm and LCC MB was applied higher than without LCC MB application. At the age of 4 and 5 years, the total N-total of peatland planted with oil palm and LCC MB applied was lower than without LCC MB application. The results of the further test of DNMRT at the 5% level of soil



Gambar 4.7. N-total tanah pada lahan gambut yang ditanami kelapa sawit dan diaplikasi LCC MB dan tanpa aplikasi LCC MB
Keterangan: *Sumber : Lupitasari (2018)

1. P-Available

Hasil analisis ragam menunjukkan bahwa P-tersedia lahan gambut yang ditanami kelapa sawit dan diaplikasi LCC MB dan tanpa aplikasi LCC MB tidak berbeda nyata. Pada umur 3 tahun menunjukkan P-tersedia lahan gambut yang ditanami kelapa sawit dan diaplikasi LCC MB lebih tinggi dari pada tanpa diaplikasi LCC MB. Pada umur 4 dan 5 tahun P-tersedia lahan gambut yang ditanami kelapa sawit dan diaplikasi LCC MB lebih rendah dari pada tanpa diaplikasi LCC MB. Hasil uji lanjut DNMRT pada taraf 5% terhadap pH tanah disajikan pada Gambar 4.8.

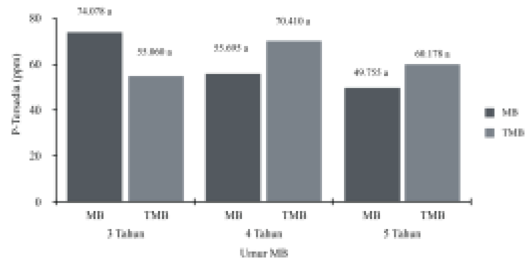


Figure 4.8. P-Available land on peatland planted with oil palm and LCC MB application and without LCC MB application
Description : *Source : Lupitasari (2018)

2. K-Total Soil

The results of the analysis of variance showed that the K-total on peatland planted with oil palm with LCC MB application and without LCC MB application was not different. At the age of 1, 2, and 3 years, the total K-total on peatland planted with oil palm and LCC MB was applied was higher than without LCC MB application. At the age of 4 and 5 years, the total K-total of peatland planted with oil palm and LCC MB was applied was lower than without LCC MB application. The results of the further test of DNMRT at the 5% level of soil pH are presented in Figure 4.9

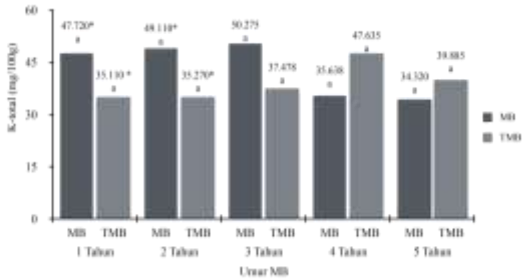


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Figure 4.9. K-total soil on peatland planted with oil palm and LCC MB application and without LCC MB application

Description : *Source : Lupitasari (2018)

2. Soil CaO

The results of the analysis of variance showed that the CaO on peatland planted with oil palm with LCC MB application and without LCC MB application was significantly different. At the age of 3 and 4 years, the CaO on peatland planted with oil palm and LCC MB was applied was higher than without LCC MB application. At the age of 5 years, the CaO of peatland planted with oil palm and LCC MB was applied was lower than without LCC MB application. The results of the DNMRT further test at the 5% level of soil pH are presented in Fig.9.

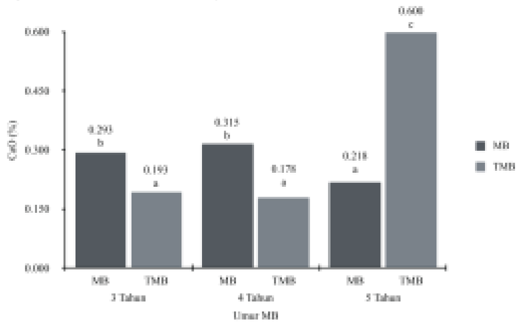

Figure 4.10. Soil CaO on peatland planted with oil palm and LCC MB application and without LCC MB application.

2. Ash content

The results of the analysis of variance showed that the ash content of peatland planted with oil palm with LCC MB application and without LCC MB application was different at 4 and 5 years of age. At the age of 3 years, the ash content of peatland planted with oil palm with LCC MB application and without LCC MB application did not differ. At the age of 3, 4, and 5 years, the ash content of peatland planted with oil palm and LCC MB was applied was higher than without LCC MB application. The results of the further test of DNMRT at the 5% level of soil pH are presented in Figure 4.11.

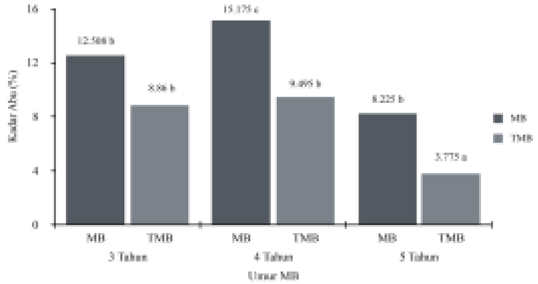

Figure 4.11. Soil CaO on peatland planted with oil palm and LCC MB application and without LCC MB application

2. Electrical Conductivity

The results of the analysis of variance showed that the electrical conductivity of the soil on peatland planted with oil palm with LCC MB application and without LCC MB application at the age of 4 years was different. At the age of 3 and 5 years, the electrical conductivity of the soil on peatland planted with oil palm and LCC MB was applied was higher than without LCC MB application. At the age of 4 years, the electrical conductivity of peatland planted with oil palm and LCC MB was applied was lower than without LCC MB application. The results of the further test of DNMRT at the 5% level of soil pH are presented in Figure 4.12.

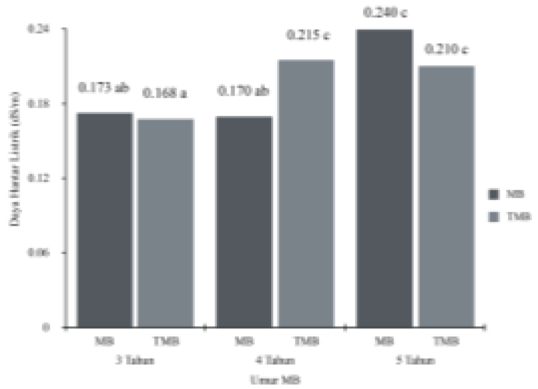

Figure 4.12. Soil electrical conductivity on peatland planted with oil palm and LCC MB application and without LCC MB application

Eviati and Sulaeman (2009) categorize the DHL level; if DHL<1 dS/m is categorized as very low, 1-2 dS/m is categorized as low, 2-3 dS/m is categorized as moderate, 3-4 dS/m is categorized as high, and > 4 dS/m is categorized as very high. The results of the DHL analysis in all treatments showed a value of < 1 dS/m, so it could be categorized as low.

2. Redox Potential

The results of the analysis of variance showed that the redox potential of soil on peatland planted with oil palm with LCC MB application and without LCC MB application was different at 4 and 5 years of age. At the age of 3 years, the potential for soil redox reactions on peatland planted with oil palm with LCC MB application and without LCC MB application did not differ. At the age of 3, 4, and 5 years, the potential for soil redox reactions on peatland planted with oil palm and LCC MB was applied was lower than without LCC MB application. The results of the further test of DNMRT at the 5% level of the redox reaction potential of the soil are presented in Figure 4.13

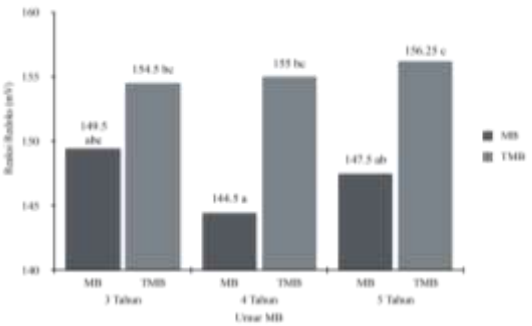

Figure 4.13. Soil redox potential on peatland planted with oil palm and LCC MB application and without LCC MB application

organic and inorganic, but also affects the acidity and redox potential of the soil.

4.3. Effect of Plant Age on Mucuna bracteata on Peat Soil Degradation

The results of the further test of DNMRT at the 5% age level of LCC MB on the physical and chemical properties of the soil are presented in Table 4.4.

Table 4.4. a further test of DNMRT at 5% level of LCC MB age on the physical and chemical properties of soil is presented in table 4.3.

Parameter	Age of LCC MB					SD
	1 year	2 years	3 years	4 years	5 years	
Field Moisture Content	318,8a*	327,8a*	577,1a*			
Water Resistant	513,86a*	524a*	554,95a*			
Weight Volume	0,16a*	0,20a*	0,18a	0,21a	0,17a	0,04
Soil pH	3,03a**	3,07a**	3,78a	3,87a	3,74a	0,16
C- Organik	37,8a**	38,87a**	43,75ab	42,41a	45,89b	1,98
N-Total	1,11b**	1,75a**	2,28a**	0,245a	0,238a	0,02
P-Available			74,08b	55,70ab	49,76a	17,01
K-Total	47,72a**	49,11a**	50,28b	35,64a	34,32a	10,88
CaO			0,293ab	0,315b	0,218 a	0,06
Ash Level			12,51ab	15,18b	8,23a	3,95
DHL			0,17a	0,17 a	0,24b	0,04
Redox Potential			149,50a	144,50 a	147,00a	5,66

Description. Numbers in the same row followed by the same lowercase letter did not differ according to the DNMRT test at the 5% level. MB = Mucuna bracteata. Source * : Arfan (2019), Source ** : Lupitasari (2019)

Field water content on peatland planted with oil palm and LCC MB was increased with the increasing age of LCC MB, but did not differ according to the DNMRT follow-up test at the 5% level. The highest field moisture content was on peatland planted with oil palm and LCC MB was applied at the age of 3 years.

The water holding capacity of peatland planted with oil palm and applied to LCC MB increased with the increasing age of LCC MB but did not differ according to the DNMRT follow-up test at the 5% level. The highest water holding capacity was on peatland planted with oil palm and LCC MB was applied at the age of 3 years.

The volume weight on peatland planted with oil palm and LCC MB was applied to increase in age, according to the DNMRT follow-up test at 5% level. The highest volume weight on peatland planted with oil palm and LCC MB was applied at the age of 4 years. Volume weight on land planted with Mucuna bracteata did not increase at the age of 3 years and thereafter. This is because the land planted with 3-year-old Mucuna bracteta cannot develop properly. The growth of Mucuna bracteata was inhibited due to shade from oil palm plants. According to Fauzi et al. (2016), light intensity without shade can accelerate and increase the growth of Mucuna bracteata. Mucuna bracteata is responsive to sunlight. Gardner (1991) suggested that several types of plants have a good growth response to high light intensity.

Soil pH on peatland planted with oil palm and LCC MB application increased at the age of 1–4 years but did not differ according to the DNMRT follow-up test at the 5% level. The highest soil pH was on peatland planted with oil palm and LCC MB was applied at the age of 4 years.

Soil C-organic on peatland planted with oil palm and applied to LCC MB increased and differed according to the DNMRT follow-up test at the 5% level. Soil C-organic was highest on peatland planted with oil palm and LCC MB was applied at the age of 5 years. The increase in the c-organic content was caused by the increase in the addition of fresh plant residues from Mucuna bracteata and oil palm fronds. According to Agus et al. (2011), sapric peat contains 48.9% c-organic, 52.27% hemic, and 53.56% fibric.

N-total in peatland planted with oil palm and LCC MB was applied to increase at the ages of 1, 2, and 3 and differed according to the DNMRT follow-up test at the 5% level (Lupitasari, 2019). Peatland planted with oil palm and applied to LCC MB at the age of 3 years had the highest total N. Total N on peatland planted with oil palm and applied to LCC MB decreased at 4 and 5 years of age.

At the age of 3 years and thereafter, there was a decrease in total N levels in the land planted with Mucuna bracteata. This is thought to be caused by Mucuna bracteata not developing maximally after the age of 3 years due to the presence of shade. Shade as a result of oil palm growth will inhibit the reception of Mucuna bracteata, thus disrupting the photosynthesis process. Because of the high intensity of sunlight, the process of photosynthesis also increases because sunlight is a source of energy for the process of photosynthesis. The results of this photosynthesis process are then used to respond to shoot growth (Fauzi et al., 2016).

P available on peatland planted with oil palm and LCC MB application and without LCC MB application differed according to the DNMRT follow-up test at 5% level. P-available was highest on peatland planted with oil palm and LCC MB was applied at the age of 3 years and then decreased with age.

The decrease in available p levels was thought to be due to a decrease in the density of Mucuna bracteta caused by shade from oil palm growth. The results of Fauzi's research stated that the length of the Mucuna bracteta plant at 0% shade was 163.03 cm, 25% shaded was 122.48 cm, 50% shaded was 89.64 cm, and 75% shaded was 80.02 cm.

The K-total on peatland planted with oil palm and LCC MB applied at 3, 4, and 5 years of age was different according to the DNMRT follow-up test at the 5% level. The peatland planted with oil palm and LCC MB was applied at the age of 3 years had the highest total K. K-total on peatland planted with oil palm and applied to LCC MB decreased at 4 and 5 years of age.

The ash content of peatland planted with oil palm and LCC MB was different according to the DNMRT follow-up test at the 5% level. The highest ash content was on peatland planted with oil palm and LCC MB was applied at the age of 4 years.

The electrical conductivity of peatland planted with oil palm and LCC MB was applied differently according to the DNMRT follow-up test at the 5% level. The highest electrical conductivity on peatland planted with oil palm and LCC MB was applied at the age of 5 years.

The redox potential of peatland planted with oil palm and LCC MB was applied and did not differ according to the DNMRT follow-up test at the 5% level. The highest redox potential was on peatland planted with oil palm and LCC MB was applied at the age of 3 years.

The assessment of peatland degradation in this study refers to Wahyunto (2018). Based on Wahyunto (2018), the parameters of soil properties include the physical and chemical properties of the soil. In this study, the parameters of physical properties include field moisture content, water holding capacity, and volume weight. Soil chemical properties include pH, C-organic, N-total, P-available, K-total, CaO, ash content, electrical conductivity, and redox potential. The level of peatland degradation can be seen in table 4.5

Table 4.5. The level of peatland degradation based on Wahyunto's proposal (2018).

Parameter	Age	Average MB	Average TMB	Significance(T-Test 5%)	Damage Level MB	Damage Level TMB
Water Resistant	1	513,86a*	443,3*		Lightly Degraded	Lightly Degraded
	2	524a*	534,2*		Lightly Degraded	Lightly Degraded
	3	554,96a*	470,17*		Lightly Degraded	Lightly Degraded
Volume Weight	1	0,16a*	0,15*		Natural Condition	Natural Condition
	2	0,20a*	0,15*		Natural Condition	Natural Condition
	3	0,19a	0,22		Natural Condition	Natural Condition
	4	0,21a	0,19		Natural Condition	Natural Condition
	5	0,17a	0,18		Natural Condition	Natural Condition
pH	3	3.78a	3.59	s	Heavily Degraded	Heavily Degraded
	4	3.87a	3.52	s	Heavily Degraded	Heavily Degraded
	5	3.73a	3.56	s	Heavily Degraded	Heavily Degraded
Nisbah C/N	3	171.224	185.99	ns	Heavily Degraded	Heavily Degraded
	4	173.10	170.75	ns	Heavily Degraded	Heavily Degraded
	5	183.81	193.99	s	Heavily Degraded	Heavily Degraded
Ash Content	3	12.508ab	8.86	ns	Natural Condition	Natural Condition
	4	15.17b	9.49	ns	Natural Condition	Natural Condition
	5	8.22a	3.77	n	Lightly Degraded	Lightly Degraded
Electrical Conductivity	3	0.17a	0.16	n	Moderately Degraded	Moderately Degraded

	4	0.17a	0.22	n	Moderately Degraded	Lightly Degraded
	5	0.24b	0.21	n	Lightly Degraded	Lightly Degraded
Soil Redox	3	149.50a	154.50	ns	Natural Condition	Natural Condition
	4	144.50a	155.00	ns	Natural Condition	Natural Condition
	5	147.00a	156.25	ns	Natural Condition	Natural Condition
P_2O_5	3	74.08b	55.06	ns	Lightly Degraded	Lightly Degraded
	4	55.65ab	70.41	ns	Lightly Degraded	Lightly Degraded
	5	49.78a	60.18	ns	Lightly Degraded	Lightly Degraded
K_2O	3	50.28b	37.49	ns	Lightly Degraded	Lightly Degraded
	4	35.64a	47.64	ns	Lightly Degraded	Lightly Degraded
	5	34.32a	39.89	ns	Lightly Degraded	Lightly Degraded
CaO	3	0.29ab	0.19	s	Lightly Degraded	Heavily Degraded
	4	0.32b	0.18	s	Lightly Degraded	Heavily Degraded
	5	0.22a	0.60	s	Lightly Degraded	Lightly Degraded

Description : s=significant, ns=non significant, Source * : Arfan (2019)

Based on the physical properties of the soil, that is water holding capacity (DMA) and volume weight (BV), the difference in the age of LCC MB does not affect the degradation of peat soils used for oil palm plantations. This means that, by referring to the peat soil degradation criteria according to Wahyunto (2018), the peat soil used for oil palm plantations with a water level of 20–79 cm that is applied to LCC MB is different in age from that which is not applied to LCC MB and has the same DMA and BV.

In terms of the chemical properties of pH and C/N ratio, the age difference of LCC MB does not affect the degradation of peat soil used for oil palm plantations. That is, by referring to the peat soil degradation criteria according to Wahyunto (2018), the peat soil used for oil palm plantations with a water level of 20–79 cm applied to LCC MB has a heavily degraded pH and C/N ratio.

Concern with the chemical properties, that is P-available, K-total, and CaO, the age difference of LCC MB refers to the criteria for peat soil degradation according to Wahyunto (2018). Peat soil used for oil palm plantations with a water level of 20–79 cm is applied to LCC MB. At the age of 3, 4, and 5 years had slightly degraded P-available, K-total, and CaO. However, based on the DNMRT test, the 5% level difference in the age of the LCC MB application is different.

For soil ash content, the age difference of LCC MB affects the degradation of peat soil used for oil palm plantations. That is, by referring to the peat soil degradation criteria according to Wahyunto (2018), the peat soil used for oil palm plantations with a water level of 20–79 cm applied to LCC MB at the age of 3 and 4 years still has soil ash content in natural conditions, but at the age of 5 years has a slightly degraded soil ash content.

On the redox potential, the age difference of LCC MB has no effect on the degradation of peat soils used for oil palm plantations. This means, by referring to the peat soil degradation criteria according to Wahyunto (2018), peat soil used for oil palm plantations with a water level of 20–79 cm applied to LCC MB and without LCC MB application still has redox potential in natural conditions.

Based on the electrical conductivity, the age difference of LCC MB affects the degradation of peat soil used for oil palm plantations. That is, by referring to the peat soil degradation criteria according to Wahyunto (2018), the peat soil used for oil palm plantations with a water level of 20–79 cm, which was applied to LCC MB at the age of 5 years had slightly degraded electrical conductivity, while at 3, and 4 years had moderately degraded electrical conductivity.

4. CONCLUSION

1. Peatland planted with oil palm and LCC MB was applied to control the degradation of physical properties (water holding capacity and volume weight) and chemical properties (ash content, N-total, P-available, K-total pH, and CaO) compared to not applied LCC MB.
2. Peatland planted with oil palm and applied to LCC MB until the age of 3 years was able to control physical properties (field moisture content and water holding capacity), but further increases in the age of LCC MB (4 and 5 years) is no longer effective in controlling the degradation of peat soil properties. planted with oil palm and applied to LCC MB was able to control the chemical properties (electrical conductivity and ash content).

REFERENCES

Adimahardja, U. Haryati, dan I. Juarsah. 2006. *Penetapan Kadar Air Tanah dengan Metode Gravimetri.* Balai Besar Litbang Sumberdaya Lahan Pertanian. Bogor : 131

Agus, F. dan I.G.M. Subiksa. 2008. Lahan Gambut : Potensi untuk Pertanian dan Aspek Lingkungan. Balai Penelitian Tanah Badan Penelitian dan Pengembangan Pertanian. Bogor

Agus. F., P. Gunarso, dan Wahyunto. 2016. *Lahan Gambut Indonesia : Dinamika Penggunaan Lahan Gambut*. Badan Penelitian dan Pengembangan Pertanian : 85-100

Aristio, A., Wardati, dan Wawan. 2017. *Sifat Kimia Tanah Dan Pertumbuhan Tanaman Karet (*Havea brasiliensis Muell. Arg*) Pada Tanah Gambut Yang Ditumbuhi Dan Tidak Ditumbuhi* Mucuna bracteata*.* JOM Faperta UR Vol. 4 No. 1 Februari 2017.

Dariah, A., E. Maftuah, dan Maswar. 2014. *Panduan Pengelolaan Berkelanjutan Lahan Gambut Terdegradasi : Karakteristik Lahan Gambut.* Badan Penelitian dan Pengembangan Pertanian Kementrian Pertanian.

Gapki. 2016. *https://gapki.id/news/1622/sawit-tanaman-realistis-di-lahan- gambut.* Diakses pada tanggal 20 Januari 2020.

Gimni. 2018. *http://gimni.org/budidaya-kelapa-sawit-di-lahan-gambut- berkelanjutan/.* Diakses pada tanggal 20 Januari 2020.

Harahap, I. Y.,dkk. 2011 edisi 2. Mucuna bracteata. Pengembangan dan Pemanfaatannya di perkebunan Kelapa Sawit, Pusat penelitian Kelapa Sawit, Medan.

Harist, A. Wawan, dan Wardati. 2017. *Sifat Fisik Tanah Dan Pertumbuhan Tanaman Karet (*Hevea brasiliensis Muell*. Arg) Pada Beberapa Kondisi Penutupan Lahan Dengan* Mucuna bracteata. JOM Faperta UR Vol. 4 No.2 Oktober 2017.

Hartatik, W. 2009. *Pemanfaatan Fosfat Alam Pada Lahan Gambut.* Balai Penelitian Tanah Badan Penelitian dan Pengembangan Pertanian Departemen Pertanian.

Hermanto, dan Wawan. 2017. *Sifat-Sifat Tanah pada Berbagai Tingkat Kebakaran Lahan Gambut di Desa Rimbo Panjang Kecamatan Tambang.* JOM FAPERTA Vol.4 No. 2 Oktober 2017.

Masganti, dan M. Anda. 2016. *Lahan Gambut Indonesia : Pendahuluan Umum*. Badan Penelitian dan Pengembangan Pertanian : 1-5

Maswar. 2014. *Panduan Pengelolaan Berkelanjutan Lahan Gambut Terdegradasi : Karakteristik Lahan Gambut.* Badan Penelitian dan Pengembangan Pertanian Kementrian Pertanian.

Noor, M., Masganti, F. Agus. 2016. *Lahan Gambut Indonesia : Pembentukan dan Karakteristik Gambut Indonesia.* Badan Penelitian dan Pengembangan Pertanian : 7-32

Rachman,A. A. Dariah, S. Sutono. 2018. *Pengelolaan Sawah Salin Berkadar Garam Tinggi*. IAARD Press. Jakarta

Safrizal, Oksana, dan R. Saraggih. 2016. *Analisis Sifat Kimia Tanah Gambut Pada Tiga Tipe Penggunaan Lahan Di Desa Pangkalan Panduk Kecamatan Kerumutan Kabupaten Pelalawan.* Jurnal Agroteknologi, Vol. 7 No. 1, Agustus 2016 : 27 - 32.

Susandi, Oksana, dan A. T. Arminuddin. 2015. *Analisis Sifat Fisika Tanah Gambut Pada Hutan Gambut Di Kecamatan Tambang Kabupaten Kampar Provinsi Riau.* Jurnal Agroteknologi, Vol. 5 No. 2, Februari 2015 : 23-28.

Tahrun, M., Wawan, dan A. I. Amri. 2015. *Perubahan Sifat Fisik Gambut Akibat Kebakaran di Desa Teluk Binjai Kecamatan Teluk Meranti Kabupaten Pelalawan.* Jom Faperta Vol 2 No. 1 Februari 2015.

Thohiron, M. dan H. Prasetyo. 2012. *Pengelololaan Lahan dan Budidaya Tanaman Lahan Terdampak Lumpur Marine Sidoarjo*. J-PAL, Vol. 3, No. 1 : 19-27

Umar, S., M. Noor, dan Noorginayuwati. 2016. *Lahan Gambut Indonesia : Kearifan Lokal Untuk Peningkatan dan Keberlanjutan Produksi Pertanian di Lahan Gambut.* Badan Penelitian dan Pengembangan Pertanian : 163-188

Utomo, M., T. Sabrina, Sudarsono, J. Lumbanraja, B. Rusman, dan Wawan. 2016. *Ilmu Tanah " Dasar-Dasar Pengelolaan"*. Prenamedia Group. Jakarta : 317

Wahyunto, 2018. *Kebijakan Sumberdaya Lahan Mendukung Pembangunan Pertanian* : *Strategi dan Kebijakan Pengendalian Lahan terdegradasi.* Balai Besar Litbang Sumberdaya Lahan Pertanian : 60-67

Wahyunto, S. Ritung, K. Nugroho, Y. Sulaeman, Hikmatullah, C. Tafakresno, Suparto, dan Sukarman. 2013. *Atlas lahan gambut terdegradasi di Pulau Sumatera, Kalimantan, dan Papua*. Badan Litbang Pertanian, Jakarta.

Wawan. 2017. *Studi Karakteristik, Fungsi, Kesesuaian, dan Pengelolaan Lahan Gambut di Area Perkebunan Kelapa Sawit PT. Subur Mandiri Lestari.* Fakultas Pertanian Universitas Riau.