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Optimization of Palm Oil Cultivation in Ultisol Land Through the Planting of *Mucuna bracteata*

Optimalisasi Budidaya Kelapa Sawit di Tanah Ultisol Melalui Penanaman Mucuna bracteata

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ABSTRAK

Pemanfaatan tanaman penutup tanah merupakan salah satu cara mengoptimalkan budidaya kelapa sawit. Tujuan dari penelitian ini adalah untuk melihat kemampuan penutup tanah menahan tanah, menahan pupuk dan pertumbuhan penutup tanah pada lahan terbuka dan tertutup. Penelitian dilaksanakan pada bulan Juli sampai Agustus 2016 di PT Rebinmas Jaya Kabupaten Belitung Provinsi Kepulauan Bangka Belitung. Metode yang digunakan metode observasi yang dilakukan yaitu berat tanah tererosi dan laju pencucian pupuk pada lahan yang ditanami dan tidak ditanami *M. bracteata* dan pertumbuhan penutup tanah pada lahan terbuka dan tertutup. Hasil uji anova menunjukkan semua perlakuan tida berbeda nyata terhadap berat tanah tererosi dan laju pencucian pupuk. *M. bracteata* tumbuh lebih cepat pada areal terbuka. Penutup tanah (*M. bracteata*) dapat menahan tanah dan pupuk, *M. bracteata* ditanam saat kelapa sawit masih muda atau belum menghasilkan.

Kata kunci: erosi, pupuk, penutup tanah, aliran permukaan

ABSTRACT

The utilization of ground cover crops is one way to optimize oil palm cultivation. The purpose of this study was to determine the ability of the land cover to hold soil, hold fertilizer, and cover land growth on open and closed land. This study was conducted from July to August 2016 in PT Rebinmas Jaya, Belitung Regency, Bangka Belitung Islands Province. The method used is the method of observation carried heavy eroded soil and fertilizer leaching rate in the area planted and unplanted Mucuna bracteata and growth of ground cover in open and enclosed land. Anova test results showed all treatments were not significantly different from the weight of eroded soil and the rate of washing of fertilizer. Mucuna bracteata grows faster in open areas. Ground cover (*Mucuna bracteata*) can hold soil and fertilizer, *M. bracteata* is planted when oil palms is young or immature.

Keywords: erosion, fertilizer, soil cover, surface run off

INTRODUCTION

Ultisol soil is classified as the most acidic soil in Indonesia. The total land area ultisol in Indonesia was 41.9 million hectares (Mulyani *et al.*, 2010). Ultisol soils have characteristics of C-organic, N-total, P-total, P-available, low K-exchange (Ewin *et al*., 2015), acidic pH (Andalusia and Arabia, 2016) as well as high H and Al (Handayani dan Karnilawati, 2013). But despite having these characteristics oil palm plants can grow on this land. Oil palm plantation (*Elaeis guineensis* Jacq) is an agricultural sector that has promising prospects for improving the Indonesian economy. Based on data from the Directorate General of Plantation (2015) the value of palm oil exports reached 17 billion US $. This export value, according to the Indonesian Palm Oil Association (IPOA) (2016) is the largest foreign exchange contributor amid the decline in national exports and states that Indonesia has a long-term target to produce 40 million tons of CPO year starting in 2020. One of the steps that can be done to achieve the target is to improve the quality of oil palm cultivation. PT Rebinmas Jaya, which is a palm oil plantation company in Belitung, has made efforts to improve the quality of oil palm cultivation by utilizing ground cover crops.

Ground cover can improve the chemical properties of the soil. According to (Ahmad, 2014), oil palm plantations that have ground cover have an average pH of 6.0, high levels of N-total, P, K, and C-organic. In addition to chemical soil cover also affects soil physics. Fuady *et al*. (2014) stated that vegetation conservation techniques (ground cover) can suppress surface runoff, soil erosion, and nutrient loss. According to (Nusyirwan, 2014) the benefits of using ground cover include reducing erosion, adding organic material, improving soil structure, accelerating infiltration and increasing nitrogen.

Research on ground cover crops on estate crops has been widely carried out. The results of the research of Marlina *et al*. (2015) planting *M. Bracteata* can add soil organic matter to rubber plantations. According to Probowati *et al.* (2014) the use of LCC *Crotalaria juncea* can reduce weed populations and the use of LCC *Crotalaria juncea, Centrosema pubescens*, dan *Pueratia javanica* can increase the yield of corn/H. Asbur *et al.* (2018) show that *Nephrolepis biserrata*, *Asystasia gangetica, Paspalum conjugatum,* and *Ageratum conyzoides* have the potential to be used as ground cover in oil palm plantations because they are easily propagated and quickly cover land. Whereas in immature areas according to Chozin, Guntoro and Murtilaksono, (2018) *Arachis pintoi*, *Centrosema pubescens Benth*, *Calopogonium mucunoides*, and *Pueraria javanica* are plants that can be used. According to Marques *et al.*(2016) the application of technology using land cover is an act of sustainable soil and water conservation. So it is good to apply.

The use of this ground cover is an appropriate alternative to improve the quality of oil palm cultivation. PT Rebinmas uses *M. Bracteata* as a soil cover that aims to reduce soil erosion and hold back the fertilizer that is given. Therefore this study was conducted to see whether the land cover at PT Rebinmas Jaya has the expected function. The purpose of this study was to determine the ability of the land cover to hold soil, hold fertilizer and cover the growth of land on open and closed land.

MATERIALS AND METHODS

This research was conducted from July to August 2016, located at PT Rebinmas Jaya in Parit Gunung Hamlet, Air Batu Buding Village, Badau District, Belitung Regency, Bangka Belitung Islands Province. The tools used include stationery, cameras, hoes, gauges, and blades. The materials used were rope, boards, used sacks, nails, palm oil plants, and ground cover plants *M. bracteata*. This study uses observations

made heavy soil is eroded, the rate of the leaching of fertilizers and plant growth observations ground cover *M. bracteata* in open and closed areas. Observation of eroded soil weight and rate of washing of fertilizers was carried out in three replications at the location of the garden:
A: there was a soil cover *M. bracteata*;
B: there are only weeds; and
C: without ground cover of *M. bracteata* and weeds.

The measurement technique for eroded soil weight is done by making a square-shaped box with a length of 1 m and a width of 20 cm which is placed in a trench that is 20 m long. The results of measurements of soil weight are obtained by weighing the soil retained in the tool after rain (g). Measurement of fertilizer leaching rate is done around the oil palm dish. This observation was carried out on oil palm plants aged five years. The technique for measuring the rate of fertilizer washing is carried out by pulling five ropes from the starting point of the fertilization path (U-shaped) to the main plant. Measurements were made one day after the rain by measuring the initial distance of the fertilizing path to the final distance of fertilizer washed away by rainwater (cm). To observe the growth of ground cover plants, four replications were carried out by measuring the horizontal extension of the plants. Measurements are made every three days by measuring the length of the plant from the base of the stem to the end of the longest plant with a meter (cm).

RESULTS AND DISCUSSION

The average weight of eroded soil at the location of the least ground cover compared to other treatments is 2.56% of location without ground cover. Locations with weeds have an average weight of 70.4% of location ground cover, while without ground cover they have an average weight of 102.5 g. This suggests that the presence of ground cover *M. bracteata* to reduce soil-borne erosion. But the anova test reaults showe that all treatment results did not have significantly different (Table 1).

The results anova test of the rate of leaching of fertilizers on planted land (Table 2). Based on anova test all treatments were not significantly different. But the results show that the most leached fertilizer is at locations without *M. bracteata* and weeds with an average flow distance of 17.8 cm, while the least fertilizer was washed at the location of ground cover *M. bracteata* with an average flow distance of 7.02 cm. Whereas, at the location there was weed fertilizer flowing as far as 13.33 cm. These results indicate that the presence of ground cover *M. bracteata* can reduce the rate of washing fertilizer. Increase in growth of most land cover at the open planting location from the first observation to the end. Observation of the location of open planting each observation increase is always higher than closed.

Table 1. Anova test analysis reasults of soil weight carried by rainwater with a frequency of 2 times rain.

	Sum of Squares	df	Mean Square	F	Sig.
Perlakuan	20704,167	2	10352,083	4,165	,052
error	22368,750	9	2485,417		
Total	43072,917	11			

Table 2. Anova test table measures the measurement of fertilizer leaching rate.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	176,018	2	88,009	,404	,685
Within Groups	1306,925	6	217,821		
Total	1482,943	8			

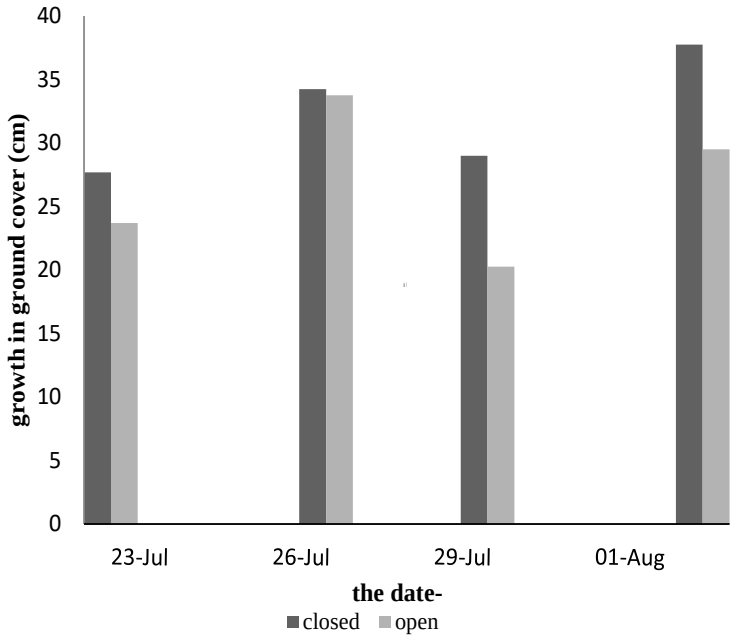

Figure 1. The average yield of the length of the *M. bracteata* areas plant in open and closed plant

The difference between the first observation is 4 cm to the second 0.5 cm to the third 8.75 and the fourth 8.25 cm. Most differences in the third observation. The results of this observation (Figure 1).

Based on the results of erosion rate measurements, at locations where land cover is groundwater *M. bracteata* overflowed, flow is less than that of *M. bracteata* and weeds of 2.5 g with an average rainfall of 6.625 mm^3/ month. This is because the cover crop *M. bracteat*a play a role in improving soil physical properties especially in enriching the soil structure of organic matter through the stems, twigs and dead leaves are falling. Dariah *et al*. (2002) say that stems, twigs, and leaves will cover the surface of the soil and reduce the strength of rainwater eroding the soil. Added by Fuady *et al.*(2014) that planting *M. bracteata* can also reduce the volume of surface run off and increase soil infiltration.

This is because the cover crop of *M. bracteata* has a fast growing power that can cover the surface of the soil so that the rainwater does not fall directly to the ground surface. The observations show that the rate of leaching fertilizer use cover land *M. bracteata* can hold the runoff. Sari *et al.* (2017) explains that when surface runoff takes place, the roots of the plant *M. bracteata* bind soil particles thereby inhibiting the movement of soil particles. This shows that fertilizer is not easily carried or washed when it rains. Nusyirwan, (2014) also said that *M. bracteata can* also protect the soil surface, reduce erosion and minimize nutrient leaching.

Palm areas that are only covered with weeds have eroded soil weight and second or middle fertilizer leaching rate. This is because weeds can hold soil particles as well but are less effective when compared to *M. bracteata*. Where *M. bracteata* can grow very fast and spread to cover the surface of the soil, while weeds grow more height. So that *M. bracteata* can maintain the integrity of the surface of the land from the rain so that little soil is carried away by water.

M. bracteata in open locations can grow faster than in closed locations. This is because plants *M. bracteata* require sunlight to its growth. Fauzi *et al*. (2016) stated that *M. bracteata* grows in 0% of the shade giving the best growth response. So it's good if *M. bracteata is* planted on young oil palm plants. at the time palm

trees have not yet produced planting ground cover is an important thing to do (Widodo *et al*., 2016). This is to reduce erosion when the palm leaves have not covered the soil.

Noegroho and Istianto (2007) stated that oil palm plantations with land cover *M. bracteata* have higher production than conventional ones. In addition to the physical properties of ground cover, it also influences soil chemistry. oil palm soils planted with *M. bracteata* according to Saputra and Wawan, (2017) have soil pH, C-organic, N-total, P-total, K-total, cation exchange capacity, exchangeable bases (Ca, Mg, Na and K) and base saturation are higher than without ground cover. Based on the results of research on the effectiveness of the use of *M. bracteata* cover crops in oil palm cultivation shows that the presence of *M. bracteata* cover crops provides benefits for oil palm plants in reducing eroded soils and the rate of washing of fertilizers. Besides, based on research by Tamrin e*t al*. (2017) planting *M. Bracteata* in oil palm plantations with a slope of 0-3% can increase the diversity of soil fauna and have better root growth. *M. Bracteata* is also influential if planted in various places, for example in the study of Oktabriana and Syofiani (2017) in the former gold mine that planting *M. Bracteata* can increase C-organic, N-total and K-dd. From the results of the study Oktabriana *et al*.(2019) states that the use of *M. bracteata* LCC can absorb more heavy metals than other LCC. *Habibah et al*. (2019) stated that giving dolomite and planting *M. Bracteata* in peat soils can increase soil fertility such as pH, exchangeable bases, N-total, CEC, and base saturation.

CONCLUSION

Planting ground cover in PT Rebinmas Jaya function in accordance with its purpose. Planting can be used as an alternative to optimizing oil palm planting on ultisol soils. Land cover can reduce soil and eroded fertilizer. Planting land cover is done when the plants are not yet producing.

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