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IMPROVING QUALITY OF KENAF FIBERS (HIBISCUS CANNABINUS L.) ON THE POSTED COAL MINING POINT USING BIOCHAR AND PLANTING MUCUNA

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ABSTRACT: *Mining techniques undertaken in Borneo generally use open pit mining with back fillings method, causing critical land resulting from the loss of ground cover vegetation, the heavy pressure of the gravitational force on the rainwater that hit direct soil surface, erosion, direct exposure to sunlight and soil compaction caused by heavy equipment use. The objective of this research is to obtain ex-coal mining area that can be used for agricultural land and plantation land by reclamation of coal mine former land with biochar and planting of mucuna LCC species, so that the soil contains good nutrient and soil texture so that the growth process the kenaf plant can grow well. The research was carried out for one years, in the area of coal mining ex-field at PT. Puspa Juwita, Muara Badak, Kutai Kartanegara as a place of planting of kenaf plant by using biochardan mucuna planting is expected to be an alternative which become option because easy, cheap and effective. The design used in this research is Completely Randomized Design in Factorial form where the first factor is biochar and the second factor is mucuna planting. The results showed that the kenaf plant can grow well on post-mining land of coal that has been given biochar and mukuna planting first. From the highest stem diameter and height of the kenaf plant the highest was seen in the B5 treatment (Biochar 100kg) and the lowest in treatment B1 (without treatment)*

KEYWORDS: Coal Mining Landfill, Biochar, Mucuna, Kenaf

PRELIMINARY

Kutai Kartanegara District is a prominent economic center in East Kalimantan region with strategic position and standing for any industries, including goods and services trading, and also with environmental friendly residence. Environmental impact due to the use of chemicals in agriculture also pushes forward sustainable agriculture technology (Mulyadi et al., 2014). One of the critical lands that have the potential to be converted to agricultural land is the former coal mine. Ex-coal mine fields usually have high density and are less fertile due to the embankment material that comes from the underground layer, both the C horizon and the ground material (Hermawan, 2002). Under such conditions, most food crops are unable to grow well due to the limited penetration of roots into the soil to obtain water and nutrients. Germination of plant seeds is also impeded on land on mine land due to crust formation and increased soil strength when the soil becomes dry (Whitemore et al., 2011).

The reclamation activity is the end of mining activity which is expected to return the land to its original state. Reclamation activities include restoration of ex-mining land to improve ecologically disturbed land and prepare for ex-mine renovated land for further utilization (Murjanto, 2011).

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Biochar is a solid material formed through the burning of materials without oxygen (pyrolysis) at temperatures of 250-500 ° C, surviving in the soil up to> 1000 years and capable of sequestering carbon in the soil (Lehmann, 2007), can improve soil fertility and be able to restore quality land that has been degraded (Atkinson et al.2010; Glaser et al.2002)

Efforts to accelerate the recovery of the quality of open mining land, can be done by planting cover crops. In the early stages can be developed for the planting of fast growing plant legumes (fast growing species) such as: Calopogonium sp., Pueraria sp. (korobenguk), Centrosema sp. and others (Ardika, 2013)

Giving biochar and planting LCC mucuna type can improve soil fertility and is one way of reclamation so that the former coal mine can be enabled. .

To reduce the impact, research on the utilization of former coal mine using biochar and planting of mucuna leguminosa species on the growth of kenaf plant. If this can be done and succeeded, then in addition to able to overcome the problems of former coal mine is also able to optimize the growth of kenaf plants and the growth of other plantation crops.

RESEARCH METHODS

A. Time and Place

This research was conducted for 1 year 2017 and the research place in the area of former coal mine land of PT. Puspa Juwita Tanah Datar Village, Muara Badak Subdistrict, Kutai Kartanegara, covering land processing, biochar application and planting of mucuna and planting kenaf (Soil and Water Laboratory of Samarinda State Agricultural Polytechnic).

B. Tools and Materials

The tools used in this research are: hoe, machetes, gembor, tugal, water pump, microkaliper, meter, drill, water hose, scales and stationery, materials used clean water, Biochar, rafia rope, plants LCC species of mucuna and kenaf plant seeds.

C. Research Design

The design used in this research is RAL Factorial Design where the first factor is biochar and the second factor is mucuna. The first factor is as follows:

B1 = without biochar / control

B2 = Biochar 25 kg / beds

B3 = Biochar 50 kg / beds

B4 = Biochar 75 kg / beds

B5 = Biochar 100 kg / beds

And the second factor is as follows:

M1 = Mucuna planting spacing 30 cm x 30 cm

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M2 = Mucuna planting spacing 40 cm x 40 cm

D. Research Procedures

1. Land preparation

Land used is land that used coal mining. Firstly we measured the soil, then cleaned up, then measured beds 2 m x 3 m, as many as 10 beds Then done soil processing and given manure to improve soil physical properties and the addition of nutrients to the soil.

2. Soil Analysis

Prior to the treatment of soil media was analyzed to determine the nutrient components in the soil to soil chemical properties. Soil analysis was conducted at Soil and Water Laboratory of Samarinda State Agricultural Polytechnic.

3. Giving Biochar and planting mucuna

Giving biochar and planting mucuna was done one month before planting of kenaf plant by way of biochar burst in existing beds, and mucuna planted on 5 (five) beds with spacing 30 x 30 cm and 5 (five) beds 40 x 40 cm with a view to adding nutrients and improving the physical properties of the soil

4. Seed Viability Test

Before the seed is planted in the field first tested the growth rate is intended to know how big the growth rate of the seed.

5. Planting

Kenaf seed planting is done by tugal as much as 3 seeds per hole with spacing of 35 cm x 35 cm.

6. Thinning

Thinning is done to leave 1 (one) plant per planting hole, done on plants aged 10 days after planting.

7. Maintenance

Maintenance includes watering, weeding, and controlling pests and diseases. Watering is done every day at the time of the afternoon if there is no rain, watering is done until the soil in the condition of field capacity or crop water requirement is fulfilled, weeding done depends on many at least weeds. To prevent pests and diseases spraying with pesticides.

E. Data Analysis Method

1. Soil analysis before treatment

2. Soil analysis after treatment

3. Added stem diameter.

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Measurements were made 30 45, 60, 75 and 90 days after planting, measured at the base of the stem (soil surface).

4. Increase in plant height.

Measurement of plant height at 30, 60, 75 and 90 days, measured from the base of the stem (soil surface) to the point of growing,

F. Data Analysis

Based on the research data obtained, to determine the effect of treatment on the observed variables are analyzed variance (F test) at a real level of 5%. If the F test of treatment shows a real effect then tested further.

RESULTS AND DISCUSSION

Research Results

1. Initial Soil Analysis of Coal Mine Initial Research

Result of analysis of land former coal mine PT. Puspa Juwita Tanah Datar Village Muara Badak District can be seen in table 1

Table 1. Result of land analysis of former coal mine PT. Puspa Juwita Tanah Datar Village Muara Badak Subdistrict

No	Parameters	Unit	Values
1	P Total	%	0,0056
2	K Total	%	0,66997
3	N Total	%	0,0524
4	C.Organik	%	0,0026
5	Mg Total	%	0,4597
6	Fe Total	Ppm	2780,00
7	Al Total	Ppm	17826,0
8	KTK	Me/100g	6,50
9	pH	-	6,00

2. Stem diameter

Average growth of Kenaf plant stem diameter at 30, 45, 60,75 and 90 days after planting for Biochar treatment 0.25,50,75,100 kg and planting Mucuna with plant spacing 30x30 cm can be seen in table 2.

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Table 2. Kenaf Plant Diameter Measurement Data at 30, 45, 60, 75, 90 Days After Planting for Biochar Treatment 0.25,50,75,100 kg and Mucuna Planting with Planting Distance 30x30 cm

treatment	Diameter with planting distance 30x30 cm				
	30 days	45 days	60 days	75 days	90 days
B1	0.644	0.762	0.915	1.334	1.511
B2	0.651	0.766	0.933	1.288	1.442
B3	0.697	0.828	1.008	1.417	1.588
B4	0.717	0.851	1.071	1.456	1.666
B5	0.748	0.906	1.168	1.655	1.888

Average growth of Kenaf plant stem diameter at 30, 45, 60,75 and 90 days after planting for Biochar treatment 0.25,50,75,100 kg and planting Mucuna with planting distance 40x40 cm can be seen in table 3.

Table 3. Kenaf Plant Diameter Measurement Data at 30, 45, 60, 75, 90 Days After Planting for Biochar Treatment 0.25,50,75,100 kg and Mucuna Planting with Planting Distance 40x40 cm

treatment	Diameter with planting distance 40x40 cm				
	30 days	45 days	60 days	75 days	90 days
B1	0.622	0.737	0.9	1.168	1.315
B2	0.624	0.74	0.913	1.222	1.346
B3	0.677	0.8	0.984	1.26	1.42
B4	0.722	0.844	1.071	1.362	1.555
B5	0.711	0.846	1.075	1.377	1.608

3. Plant height

Meaning of Kenaf Plant High Growth at 30, 45, 60.75 and 90 Days After Planting for Biochar Treatment 0,25,50,75,100 kg and Planting Mucuna with Planting Distance 30x30 cm can be seen in table 4.

Table 4. Kenaf Plant High Measurement Data at 30, 45, 60, 75, 90 Days After Planting for Biochar Treatment 0,25,50,75,100 kg and Mucuna Planting with Planting Distance 30x30 cm

treatment	High Plants With Planting Distance 30x30 cm				
	30 days	45 days	60 days	75 days	90 days
B1	27.4	79.088	142.755	167.688	175.533
B2	28.933	79.488	148.555	171.178	178.378
B3	28.488	80.688	152.133	175	183.557
B4	30.955	84	158.133	181.888	190.578
B5	31.466	84.8	167.956	188.6	202.133

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Kenaf Plant High Growth Rates at 30, 45, 60.75 and 90 Days After Planting for Biochar Treatment 0.25,50,75,100 kg and Planting Mucuna with Planting Distance 40x40 cm can be seen in table 5.

Table 5. Kenaf Plant High Measurement Data at 30, 45, 60, 75, 90 Days After Planting for Biochar Treatment 0.25,50,75,100 kg and Mucuna Planting with Planting Distance 40x40 cm

	High Plants With Planting Distance 40x40 cm				
treatment	30 days	45 days	60 days	75 days	90 days
B1	28.977	79.4	145.066	170.177	177.622
B2	28.466	80.977	151.311	174.6	181.888
B3	29.622	81.088	154.8	177.222	188.066
B4	31.133	84.846	161.667	189.911	199.689
B5	31.688	88.688	168	195.488	207.489

4. Soil Analysis of Former Coal Mine Research

Result of analysis of land former coal mine PT. Puspa Juwita Tanah Datar Village Muara Badak Subdistrict end of research can be seen in table 6

Table 6. Result of land analysis of former coal mine PT. Puspa Juwita Tanah Datar Village Kecamatan Muara Badak End of Research

No	Sample code	P Total	K Total	KTK	N Total
		%	%	mmol/100g	%
1	1	0.1110	0.69110	7.20	0.230
2	2	0.0981	067685	6.80	0.210
3	3	0.2560	0.73151	12.30	0.289
4	4	0.1031	0.68987	10.60	0.220

DISCUSSION

The result of initial soil analysis showed that macro nutrients N, P, K, Mg have low value. Similarly, low organic C content is likely to cause the KTK value of the soil is not too large. El element also has a role to reduce KTK when it is in the ground with a large amount. Fe element is included in the micro nutrients needed by plants in very small quantities, but if it exceeds the needs of the plant will become toxic elements or disrupt the growth of plants. The low KTK is also generally proportional to the low pH (acid state).

Ex-coal mine land has high density and low fertility due to the material of embankment that comes from the underground layer, and heavy equipment traffic during the mining process. The mining of conventional open systems alters many landscapes and balances of terrestrial ecosystems, decreasing soil productivity and environmental quality. Coal mining causes major damage to the flora, fauna, hydrology, physical, chemical and biological properties of the soil (Kumar and Pandey, 2013).

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The results of the second soil analysis are higher than the results of the initial analysis of both N, P, K, C,KTK and pH values, since the former coal mines were given biochar and mucuna grown, can grow well in less fertile soil conditions very fast growth. Biochar also improves the quality and quantity of water by increasing the retention of soil nutrients and agricultural chemicals for the utilization of plant growth, while mukuna plants have abundant biomass, stems and leaves easily decayed so that is a source of organic materials that can add nutrients and fertilize the soil in plants, capable of fixing nitrogen from the soil and erosion retaining because its leaves are able to cover the soil perfectly (Suwardjo, et al, 1989).

The increase in macro-element content is caused by the provision of biochar and planting of mukuna prior to planting kenaf, with this treatment can improve the physical properties of the soil to support the growth of the plant. Based on the results of the analysis that has been done, can give positive results on the improvement of soil physical properties seen in kenaf plant growth.

Treatment by adding biochar and mucuna crops in the former coal mine can be used as agricultural land and plantations that will accelerate the recovery process of former coal mining areas. This will cause the original land can only be planted with a few types of plants will experience an increase in quality so that it can be planted by several types of plants. The kenaf plant can be developed on the land and the microclimate conditions at the former mining site will also be improved by cultivating agricultural crops and plantations at the site.

Results of stem diameter and plant height calculation at 30.45, 60.75 and 90 days with plant spacing 30x30 cm and 40x40 cm, from five treatments B1 (without treatment), B2 (Biochar 25 kg), B3 (Biochar 50 kg), B4 (Biochar 75 kg) and B5 (Biochar 100 kg) the largest diameter of the stem is at the B5 treatment and the lowest in B1.

The result of variance analysis showed that F arithmetic <F test table 5% and 1%, on five treatments gave significant influence to the increase of stem diameter and tanama height. Providing biochar and planting mukuna on ex-mining reclamation sites is able to add nutrients that can restore soil quality to soil damage levels so that the growth of kenaf plants can grow well.

According to Subowo (2011), that by planting LCC species mukuna can change the physical, chemical and biological environment such as soil conditions, water quality, vegetation pattern and fauna habitat, and so on. Mucuna plants are able to grow and produce large amounts of organic material, mucuna root can improve soil physical properties and improve soil fertility.

According to Steiner et al (2007), the addition of nutrients required by the plant in sufficient quantities then the growth of the plant will be good. As stated by Daniel et al (1987), that the success of growth is determined by internal factors (genetic and hormonal) and external factors (climate and quality of place of growth). Potential types for reclaimed former coal mines are selected based on their ability to adapt to the reclaimed soil conditions, as well as the availability of seeds (Adinugroho and Sidiyasa, 2009).

From the results of research kenaf plant is a fast growing plant species and relatively more effective in absorbing water, nutrients and solar energy and CO2, because the acceleration of growth is closely related to the process of physical metabolism, especially the process of photosynthesis. Since the condition of the former mine land is in poor nutrient condition, it is necessary to consider the selection of fast-growing species that are not nutrient-rich. The plant

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of kenaf seen from the increase of stem diameter and plant height on the treatment of B5 (100 kg Biochar) growth is good because there are mukuna plants that play a role in accelerating the process of microclimate formation and soil condition improvement so as to accelerate the process of vegetation succession because it creates conditions that allow for entry and the growth of other types of vegetation.

In the treatment of B1 (without treatment) on the diameter of the stem and the height of the plant is seen the lowest growth, this is because the physical properties of the soil such as texture, consistency, structure, boundaries between soil layers and changes in soil chemical properties such as nutrient content in soil N, P, K , C-organic, soil pH, physical changes of morphology and land topography, and micro-climate change caused by changes in wind velocity, disturbance of biological habitat in the form of flora and fauna, and decreasing soil productivity causing mine soil becomes infertile and infertile (Pribadi, 2012).

The nutrient deficiency that exists in the former coal mine can inhibit the growth of planting, the lack of nutrients causes stunted growth and development of crops and directly affect the productivity of crops (Ardhiansyah and Sumarsono, 2014)

With reclamation as an attempt to repair or restore damaged land as a result of mining business activities should be done as early as possible by planting crops to create soil surface can be stable, nutrient formation through decomposition of leaf litter, improve soil as planting medium for safe conditions and not eroded so young can be reused. Need for plantation, plantation and forest development plan (Subowo, 2011)

CONCLUSION

From all research activities that have been done up to the stage of preparing this report can be concluded while that:

1. It is seen that there is an influence of biochar administration and mukuna planting on the improvement of physical properties of former mining land owned by PT. Puspa Juwita Tanah Datar Village Muara Badak District Kutai Kartanegara Regency.

2. Seeing from the data of diameter and height increase of plant of kenaf that is produced until at age 90 days after planting, seen at treatment of B5 (100kg / bedengan) visible kenaf plant growth better than all treatment and percentage of life of kenaf plant by 100%.

3. Ex-mine land that has been given biochar and mukuna planting can be used as cultivation area of fiber plants in this case Kenaf plant (Hibiscus cannabinus L).

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