

## THE GROWTH OF RUBBER IN THE PERSPECTIVE OF GEOMORPHOLOGY AND SOIL CHARACTERISTICS IN JEMBER INDONESIA

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### ABSTRACT

This study aimed to analyze the suitability of land that can be covered with rubber trees and other vegetation in Jember in the perspective of geomorphology and soil characteristics in Jember Indonesia. The research method used was survey and laboratory testing on soil samples taken from the study area. Five samples taken at different points. The analysis technique used in the form of descriptive analysis. The results showed dominated by clay soil texture, soil moisture worth 9-10 that indicates the soil is very moist. The old volcano as geomorphological factor has significant impact for high production of rubber in jember. Soil pH range 6-7 slightly acid to neutral. Soil organic matter content is very high and produce a lot of foam when reacted with H<sub>2</sub>O<sub>2</sub> identified from soil dark brownish black.

**Key words:** Land Suitability, Rubber, Jember

### INTRODUCTION

Results plantations in Indonesia is one sector that is relied upon to increase state revenues. This plantation is still promising given fairly extensive land throughout Indonesia. Both public and private companies widely established in Indonesia as PTP Nusantara. Indonesian soil and climatic conditions are suitable for plantation trigger optimization efforts plantation products in Indonesia.

One plantation crops grown in Indonesia is rubber. The rubber plant is a plant that has a high economic value. Not long to grow these plants only need 5 years already tapping sap. Rubber plantations in Indonesia, including the largest rubber plantations in Southeast Asia with an area of 3.5 million hectares. The existence of the above facts it is necessary to well manage. The

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characteristics of each area of course vary, therefore the assessment of the condition of the land needs to be done before planting. Adjustment of soil conditions, good cultivation techniques necessary so that productivity can reach a maximum target.

Have recently experienced problems of agricultural rubber crucial for disease. Reported *Bisnis.com* (Newswire, July 31, 2018), agricultural diseases such rubber leaf fall disease (*Fusicoccum*) attacked rubber plantation in seven provinces in Indonesia. Authority Gede, Bogor Rubber Research Center Director stated that the autumn leaves was first detected in 2016 in North Sumatra. After a few years later, in 2018 there were approximately seven provinces (North Sumatra, South Sumatra, South Kalimantan, Southeast Sulawesi, Central Java, East Java, and Lampung) who contract the disease this autumn leaves. According to Gede Authority is one of the causes of climatic factors and the lack of durability of rubber Indonesia. Of the seven provinces, about 22,000 hectares of land are affected by the disease fall leaves, The raw data obtained from company reports in seven provinces as of February 2018. As a result of this incident latex production has decreased. Banyuasin Sumbawa rubber plantation, which was supposed to produce 180 tons of harvest season in July-August, but only 90 tons with total area of 905 hectares. It is known that rubber production decreased 40-50% in 2018.

Achmad and Aji (2016) explained that the soil factors have an important role for the growth of rubber plants. Some indicators of soil must be met for the rubber trees can grow well which have a pH ranging from 6 to 6.42. The texture of the soil affects the soil structure, macro and micro activity in the soil. Besides the above, the efforts made in managing the rubber plant also has an important role, such as manure, the use of clones, mulch. Although rubber is not included plants that are difficult to grow, if the handling is not appropriate rubber will not grow optimally, because many existing crop pests. Today, many evolving techniques of rubber cultivation. Not only the look of natural factors as well that soil and climate conditions, but taking another way to make rubber plants grow well. One is diversification. This technique is a crop diversification efforts that exist around rubber plants. Was found a lot of rubber plantations interspersed with other crops such as sugar cane. The benefits of this *perselingan* can keep rubber plants from pests and land use. Noorcahyati, et al (2016) explain that action *perselingan* rubber plantations with other crops can protect plants from plant species *pengganggu* rubber. However, please note diversion planted crops must correspond primarily to rubber plantation. Based on the above problems, hence the author examines the problem of land suitability for rubber plant growth, and takes the title "Suitability of Soil Against Rubber Plants and Other Vegetation in PTP NUSANTARA Rubber Plantation XII Glantang".

## METHOD

The method used for surveying the field and laboratory testing. The field survey was conducted to determine the condition of the rubber plantation Glantangan PTP Nusantara XII, as well as soil sampling which will then be carried out laboratory tests. Soil sampling using ground ring. Besides measurement of humidity and pH using Moist Soil PH Detector Analyzer. Determination of soil color using Munsell Soil Color. Laboratory tests conducted to measure the concentration of organic matter in the soil using a chemical solution of 50% H<sub>2</sub>O<sub>2</sub>. Determination of soil texture conducted qualitatively by the sense of touch. The analysis technique used is descriptive analysis. In conducting the required analysis of several indicators, among others:

Table 1. Indicators Research

No.	Measurement indicators
1.	Coordinate
2.	Elevation
3.	Humidity
4.	Ph
5.	Organic ingredients
6.	Texture
7.	Color
8.	Geomorphology

Table 2. Point Location Research

Name Location	Coordinate
A	S = 08019'143.82 "E = 113041'15.61"
B	S = 08019'31.25 "E = 113041'00.61"
C	S = 08019'148.79 "E = 113042'30.31"
D	S = 08020'11.77 "E = 113042'17.88"
E	S = 08018'23.63 "E = 113041'47.39"

## RESULTS AND DISCUSSION

### Results

The results of measurements performed at five points PTP Nusantara XII Glantangan research Jember include measurement of elevation, soil texture, soil moisture, soil pH, organic matter, soil color and vegetation companion rubber plants. Pengukuran The results can be seen in the table below:

Table 3. Results of Measurement Some Properties of Soil

locations	elevation	Soil texture
A	76 m	Smooth (a dusty clay)
B	81 m	Somewhat Smooth (clayey loam)
C	75 m	Medium (clay dusty)
D	73 m	Rather coarse (fine sandy loam)
E	84 m	Smooth (a dusty clay Clays)

*Source: Data Measurement and Test Laboratotium 2019 Soil Sample*

The texture of the soil in the study area is divided into five classes: dusty clay, clayey loam, dusty loam, sandy loam, clay loam dusty (Table 3). Soil structure in penentunnya influenced by the comparison between the particles of clay, sand, and dust. The main content in the soil that affect the structure of Rubber Plantation Glantangan is the structure of clay and sand. Different textures of each study site occurs due to differences in soil-forming factors, such as climate, parent material, topography, time, and vegetation. A study soil in a land that has a dusty clay structure, so that when it is done using the thumb touching land obtained results indicate the location A has a smooth texture. Land at the location B has a clayey loam structure and produce rather fine particle structure. Land at the location C has a dusty clay structure and indicate medium texture. Ground level in the D has the structure of fine sandy loam, showed slightly rough texture. Land at the location E has a dusty clay loam soil structure show rather smooth texture.

Table 4. Results of Soil Moisture Measurement

locations	Humidity	Information
A	10	very Moist
B	10	very Moist
C	10	very Moist
D	10	very Moist
E	9.5	Moist

Source: Data Glantangan 2019 Plantation Field Measurements

Based on the data in Table 4, the average soil moisture worth 10. Soil moisture indicates the number of water content contained in the soil. Humidity can be used to measure the degree of dryness of a land. The higher the number, the smaller the moisture level of dryness of a land. It can be concluded that the observation locations have an average water content much so that a small degree of dryness. Humidity research areas that have a value between 9-10 at a depth of ± 20 cm.

Table 5. Results of Soil pH Measurement

Locations	Soil pH	Information
A	7	Neutral
B	6	sourish
C	6	sourish
D	6	sourish
E	6	sourish

Source: Data Glantangan 2019 Plantation Field Measurements

Based on the above data, the average pH of the research area is pH 6. This shows the level of acidity. Sour-base reactions in the soil can affect the rate of decomposition of mineral and organic matter, forming clay minerals, the activity of microorganisms, the availability of nutrients for plants and directly or indirectly affect plant growth. zoom the soil pH at 1-14. pH was at five points in PTP Nusantara XII Glantangan has a soil pH that is different. A point of rubber land has a pH of 7, while at points A, B, C, D has a pH of 6. The pH soils showed 6-7 can be interpreted react somewhat sour-neutral.

Table 7. Results of Measurement of Soil Organic Matter and Color

locations	Organic ingredients	Soil color
A	A lot of froth, high organic matter	2.5 YR 3/3 Dark Reddish Brown
B	A little froth, low organic matter	5/4 10 YR Brown
C	A lot of froth, high organic matter	5/6 10 YR Yellow Wish Brown
D	A lot of froth, high organic matter	Brown 7.5 YR 5/4
E	Foamy medium, organic materials are being	4/6 10 YR Yellow Wish Dark Brown

Source: Data Measurement and Testing Laboratory Field Plantation Glantangan 2019

Based on research that has been done on average organic matter content has a lot of trials using the organic with 50% H<sub>2</sub>O<sub>2</sub> reaction produces a lot of froth. This indicates that a lot of froth high organic matter content. A location that the soil found in standard colors on Munsel book soil color chart has 2.5 YR 3/3 Dark Reddish Brown. The land has a value of 2.5 YR hue value 3 and Chroma 3 and generate a lot of froth. This indicates that the content of organic matter contained in the soil is high. On the ground measurements with location B Brown 5/4 results obtained results indicate memliiki brown color and high organic matter content. On site measurement C has the result 5/6 10 YR Yellow Wish Brown. The land has a brown color. Location D result 7 5/4, 5 YR Brown obtained brown. E research location has 10 YR 4/6 result wish brown or dark yellow overall had a brown color.

Table 6 distribution of the region of Jember based on geomorphological factor and its relation to rubber growth (Research finding, 2019)

Region	Volcano Type	Impact on the rubber growth
Argopuro	quarter	low
Arjasa	Quarter	low
Bangsalsari	Mixed (quarter-tertiary)	low
Tanggul	Mixed (quarter-tertiary)	ow
Mayang	Tertiary volcanic	high
Silo	Tertiary volcanic	high
South Jember	Tertiary volcanic	high

The table above explains the influence between the types of volcanic mountains and the growth of coffee. The growth of coffee in a tertiary volcano is very good. This is caused by a combination of groundwater aquifer systems with air temperature and elevation.

## **Discussion**

### *Soil texture*

The soil texture indicates the relative ratio between the fraction of sand, silt, and clay (clay). Soil texture of a piece of land will affect the level of aeration, fertilizing the soil and easily whether the processing of land. Based on the results of measurements that have been done, the average land area of research fifth point has the texture of clay. In the triangle classification according to the USDA soil texture clay fraction has a very high surface area. clay fraction affects the availability of plant nutrients. Land in Rubber Plantation teksur Glantangan dominated by clay. According to the Rubber Cultivation Technical books issued by the Directorate General of Plantation (2009), the right soil to plant rubber textured sandy loam and sandy clay. This indicates that the texture of the land area suitable for planting rubber research. Clay-textured soils can absorb nutrients properly. Siregar (2018) describes the textured clay soil has a larger surface of the sand so that the ability to hold water and nutrients mempunyai high. The texture of the clay can be made where runoff also reduces the durability of the ground (Kurnianto, 2018). Rubber also will not grow if waterlogged excessive, but the area of research that has tekstru clay, rubber plants also continue to grow, Besides it supported by the findings of clay-textured soils derived from basic rocks clay has the ability litifikasi long as part of the alluvial plain (Kurnianto, 2019), so it will play a role in retaining water that affect the nutrients and aeration. The results also showed that soil texture varies greatly not only alone but clay dusty loam, clayey loam, dusty loam, sandy loam, clay loam can dusty overgrown rubber plantations.

### *Soil moisture*

Soil moisture depends on soil texture. Fraction of the soil in the ground showing grain texture / pores of the soil. The texture of sandy soil will have the ability to store water is low. Sandy soil texture will spend water supply quickly because the water storing capacity is very low, so that dry faster than plants growing in clay. High and low soil water-holding will mempengaruhi size of soil moisture. The findings Karamina (2017), soil moisture depends on climatic factors such as temperature and humidity. Relation to atmospheric

humidity, excessive evaporation will occur in areas with low air humidity and heat, ground water and consequently rises capillary into the soil profile. The situation is causing land Humidity level is low. As mentioned above, soil moisture depends on climatic conditions. Climate is a soil forming factors. When managing land using organic materials which one it will result in the increase of heavy metals and is absorbed by plants. Salinity will increase thereby affecting the process of soil formation. Total soil organic influenced by the nature of organic materials that are returned, the level of soil aeration, temperature, soil moisture, nutrient supply of properties. Measurement of soil moisture is needed to determine whether the soil is dry during the dry season and wet in the rainy season. By knowing the level of soil moisture can help optimization tillage and increase land productivity. Weather conditions in the study area that are still included in the transitional season between the rainy and dry seasons, rainfall in the study area is also quite high, resulting in high soil moisture, which ranges from 9-10.

### *Soil pH*

pH was good with plants suitable conditions will allow farmers to cultivate the maintenance of the park so it is not too much. Rubber plants must have the proper acidity level that does not affect the growth processes in plants rubber itself. The rubber plant is a plant that is often grown on plantations. pH study area that shows the depth of 0-20 cm 6-7 with a pH suitable for growing rubber. Nurmegawati, et al (2014) pH corresponding to the rubber plant is 4-6. According to the General Guidelines for rubber cultivation by the Directorate General of Plantation (2009), a good ground for the cultivation of rubber has a pH of 4.3 to 5. This is not consistent with the findings in the field. Rubber plants can grow well despite having a pH of 6-7. Plant growth is influenced by soil reaction. Ground reaction is the level of acidity and alkalinity of the soil pH is expressed through the numbers. Availability of plant nutrients in the form of N, S, P, K affected by pH. Generally all the nutrients will be available when the pH of the soil in normal / neutral. According to the diagram of the effect of pH and availability of the chemical elements in the soil by Forth (1990), Nitrogen, Phosphorus, Sulfur is available in neutral pH. Iron and Manganese are available in an acidic pH. The pH value is also influenced by crop fertilization. Karamina, et al (2017) explain that the acidic pH arising from the use of fertilizers and continuous long-term. Inorganic fertilizers such as ZA will produce excess acid, the water will be hydrolyzed into H + ions. The acidity of the soil pH can be maintained using a buffering soil.

Rubber plant that has a normal pH will not need compost or other fertilizers to be done because ph fertilization or fertility of the rubber plant is appropriate (Firman, 2013). New discoveries in the study area itself does Glantangan



plantation of rubber trees that flourish in spite of having pH 6 and 7. The factors of disease to be controlled in this rubber plant and must have the right balance of plants such as pH balance. Factors temperature, pH, and moisture is the biggest factor for controlling the rubber trees that are in the area of plantation (Diamond, 2013). Having a good soil fertility rubber then growth will increase, so that it can be concluded that the soil pH ranged PTPN XII Glantangan 6-7 still viable for planting rubber.

### ***Soil Organic Matter and Color***

Soil fertility can be seen from the color of the soil, organic matter content, pH of the soil, and vegetation growing on the land. Soil color can be used as an indicator measuring soil parent material, climatic conditions found in the area, and the latter can be used as indicators of soil fertility. Measurement of soil color is based according to a standard color on Puku Munsel soil color chart which, in the book there are three indicators namely hue (color spectrum is dominant in accordance with the wavelength), value (darker lightness in accordance with the reflected light), and Chroma (degree differentiator discoloration of gray or neutral white). According Saptaningsih (2016) of organic matter in the soil affects the properties that exist on the ground covering properties of biological, chemical fiisk and high organic tanah.bahan can be used as an indicator of soil fertility. In addition to organic matter, there is also the color of the land used as an indicator of soil fertility.

From the results of these measurements can be concluded that the soil contained in the Rubber Plantation Glantangan has fertile soil. Organic materials help provide substances for the plants to the formation of soil aggregates, help control runoff and erosion, improve water binding capacity and pass water. Soil organic matter affects soil properties such as color, structure, aggregate stability, pH, cation exchange capacity. According Margolang et al (2015) soils with high organic matter that can be said better soil and the soil has a dark color. Humus has a high organic matter content, which contribute color pigmentation colloidal humus black soil. Soil that has high organic matter usually has a darker color value and chroma value  $\leq 3$  (Sartohadi, 2016). As in the A site that has a value and chroma value of 3 and generate a lot of foam when reacted with H<sub>2</sub>O<sub>2</sub> 50%. Based on the research results, obtained new discoveries if Glantangan Rubber Plantation has a variety of colors at points B, C, D, E. Mostly of the four locations consisting of a dark brown, yellowish, until brown. If the previous researchers say that the dark color soil has a high organic matter of the present invention is that even dark colors do not land still has a high organic matter content. Organic matter content is influenced by soil depth and drainage. According Nurmegawati (2014), organic material at a depth of 0-20 is higher than the layer below it. Suharta (2017) To suggest that the productivity of the land is

not determined on the basis of soil fertility naturally however, is determined by soil and plant responses to the application of the technology used in land management. In this case, researchers found that not only the land that has a black color (high fertility) however, suitable land will be able to make the tumbuhpasdatanah plants that have high productivity. Plants rubber plantations grow on land glantangan average has brown and yellowish brown brass. From these facts indicate that soil fertility levels are not too high can result in maximum productivity.

### ***Accompanying vegetation Rubber Plant***

Based on the survey results in PTP Nusantara XII Glantangan, besides the plant arch which became another major commodity crops are also planted around the rubber tree. Plants grown very varied including cocoa, sugar cane. Tropical areas situated around the equator in this area, especially adjacent to the ocean much rain. The influence of the evaporation of sea water during the day, the type of plants that grow varies, so in this area often encountered heterogeneous forests, plants that were found are from plantation and agriculture (Fachan, 2013). Soil in the study area is the land latosol. Latosol is a land that has progressed or differentiation occurs horizon. Latosol have ranges of properties in the solum, plate texture, crumb structure to blocky, friable consistency until firm, brown, red to yellow.

Vegetation in this Glantangan rubber plantation that was planted with rubber trees with an area of 1414.3 hectares, beberepa types of wood with an area of 390, 66 hectares for breeding 15.18 hectares and a small part planted by cocoa, sugar cane and beans (PTPN XII Region II Glantangan, 2012). The area is suitable as plantation because has fertile soil of this area has soils derived from tuff host rock originating from letuasan Mount Argopuro. Robby (2018) explain that the use of plantation land will have an impact on environmental degradation and the decreasing availability of the function of a neighborhood. One effort made is perselingan partly used as a cover crop land. Nuts are suitable for use as a soil cover because the plants that grow vines well as a small plant roots will not interfere with the main plant. Controversies crops such as sugar cane and cocoa done because of the step diversification, but it also prevents the plant perselingan rubber plants exposed to pests.

Vitello (2013), land is a state of the landscape influenced by the physical environment, climate, topography or relief, hydrology and vegetation that enveloped it and then it will affect the use of the land. Rubber Plantation Glantangan predominantly planted rubber trees has a climate and warm temperatures while the rubber plantations are common in low temperature. Topography or relief was also flat while the rubber plantations usually synonymous with mountainous terrain. Rubber plantation in Glantangan affected by the depression and tuff and breccia bedrock of Mount Argopuro

so despite being in a low-lying area is still suitable for planting rubber trees. Latuamury (2012), challenging vegetation in fertility soils due to the abundant activity of vegetation organisms in rubber plantations. Solid challenges with complications of rubber plants, sugar cane, cocoa, and a few sengon gardens. The groundwater aquifer system in Jember will have an infiltration effect that is not the same in one year. This is supported by elevations above 50 meters from sea surface. This is supported by Kurnianto (2018) the research results showed that several regions in North Jember and South Jember. Mid Jember is an older volcanic depression compared to the surrounding region. South Jember is a karst zone that is very vulnerable to losing the ability to store a ground water.

## CONCLUSIONS

Land suitability study PTP Nusantara XII overall Glantangan according to plant rubber. The soil texture dominated by clayey and sandy loam is in accordance with a rubber plant. Moist soil moisture helps keep the rubber plants from drought. suitable soil pH so it does not need to be done on the ground pengkapuran this rubber plantation. Organic matter that provides nutrients that either assisted with land cover and perselingan the plant to avoid the erosion of rubber plants and plant pests.

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