

CHANGES IN SOIL CHEMICAL CHARACTERISTICS DUE TO PLANT FOREST EUKALIPTUS SECOND GENERATION IN TAPANULI UTARA

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ABSTRACT

Research to evaluate the chemical characteristics of the soil under the stand of second-generation Eucalyptus sp. plantations in Aek Raja Village, ParmonanganSub District, North Tapanuli compared to the characteristics of secondary forest land, dominated by pine merkusii in July-August 2018. using a survey method with purposive sampling in both types of land use as many as 3 replications (observation points) with a depth of 0-40 cm. Soil samples were analyzed at the USU Laboratory of Soil Science Faculty of Agriculture to obtain data on pH, organic matter, and soil, N, P, and K nutrient content. Data were analyzed statistically using variance analysis and continued with DMRT test. The results showed that the levels of P and K nutrients and the levels of soil organic matter under both stands of land cover were not significantly different, while the value of soil pH was higher in eucalyptus plantations and was significantly different than the pH of the soil under the stands of secondary forests, dominated pinemerkusii. On the other hand, the total N-soil content is higher in secondary forests and is significantly different from that in eucalyptus soil. Open soil chemical properties (without vegetation) are relatively similar to the chemical properties of soils under the stands of eucalyptus and pine forests, except that N-total is much lower in open soils (land without vegetation).

Keywords: soil chemical properties, eucalyptus (silviculture) plantations, pinemerkusii secondary forest, Tapanuli Utara.

A. PRELIMINARY

Eucalyptus trees in Indonesia are one of the mainstay of pulp-producing plants other than Acacia mangium. The cultivation of this crop has been carried out on a large scale, especially by industrial timber plantation companies (HTI). In Riau Province the cultivation (silviculture) of this plant has reached the third generation (Supangat, et al., 2012), while in North Sumatra it has entered the second generation. Eucalyptus sp. has been known since the 18th century, and in Indonesia experienced a rapid development in 1980 after the VIII World Forestry Congress in Jakarta in 1978. However, in 1988 there was criticism and protest against this plant because of indications of negative influence on the environment (Pudjiharta, 2001). In India, it was reported that Eucalyptus sp. has caused disasters due to lack of water because it has high water consumption for its growth (Bruijnzeel, 1997).

PT. Toba Pulp Lestari (TPL) is a forestry company in North Sumatra engaged in the pulp industry for paper raw materials and raw materials for rayon fiber with its main raw material for Eucalyptus wood. Development of Eucalyptus sp is done by crossing the types of Eucalyptus sp which can be expected in response to the lack of wood needs. Currently the results of crosses that have superiority and are widely seeded at the nursery of PT. Toba Pulp Lestari is the result of a cross between Eucalyptus grandis and Eucalyptus urophylla namely IND 47, IND 61 and IND 60. Eucalyptus planting areas, both with HPH schemes and Community Timber Plantations covering an area of 5,228 hectares in 9 regencies, namely

Tapanuli Utara, Simalungun, HumbangHasundutan, South Tapanuli, Dairi, Samosir, Toba Samosir, Padanglawas Utara, and Pakpak Bharat. Eucalyptus trees abort their branches to maintain the balance of the tree, resulting in straight and high stems, branch-free, and cylindrical. Characteristics of wood like this that cause eucalyptus trees to be used as raw material for the pulp industry.

Plant forest (silviculture) is essentially a cultivation system (gardening) of forest plants whose cropping patterns resemble those of plantation crops. Plants are cultivated with a certain spacing, according to the characteristics of the tree, by controlling disturbing vegetation on the intervening land. That way, it is estimated that it will affect the decline (degradation) of the nature of the soil compared to natural forests, moreover it has been used for more than one crop cycle. In connection with this, research has been conducted to examine changes in soil characteristics due to the second generation of eucalyptus plantations.

B. MATERIALS AND METHODS

The study was conducted in Aek Raja Village, Parmonangan District, NorthTapanuliKabupaten from July to August 2018. The study used a survey method with purposive sampling atandic soils of land used for second generation eucalyptus (Eucalyptus urophylla) forest (at coordinate N 02°07'50,40"; E 098°50'51,27")and secondary forest,dominant pinemerkusii (at coordinate N 02°07'43,36"; E 098°50'32,04"),as much as each 3 replications (observation point) with a depth of 0-40 cm. Soil samples were analyzed at the USU Laboratory of Soil Science in order to obtain soil

chemical data consisting of pH, organic matter, and soil, N, P, and K nutrient levels. Data were analyzed statistically using variance analysis and continued with DMRT test. Observation and soil sampling based on layers (soil profile) was also carried out on open soils (without vegetation) at the study site (at coordinate N 02°07'59,67"; E 098°50'18,42"). The research location is at an altitude of 1465-1470 meters above sea level with flat to wavy reliefs.

C. RESULTS AND DISCUSSION

The results of variance analysis followed by DMRT test on the data of soil chemical properties under the stand of both types of forest showed that the mean value of soil pH was higher in eucalyptus plantations and was significantly different from the soil pH in pine secondary forest, although it was relatively acidic (M) Whereas the total N-soil level was lower in eucalyptus plantations and was significantly different compared to the nature of the soil under the stands of secondary forests dominated by pine trees. The chemical properties of other soils are not significantly different (Table 1). N-total soil in pine forests is very high (ST), while in eucalyptus forests is high (T).

The higher the pH of the soil in eucalyptus forests is made possible by fertilizing and giving dolomite to eucalyptus cultivation, while agronomic forests are not carried out. While the increase in N-total levels in secondary natural forest land is possible due to the more decomposition/mineralization of organic matter in relatively undisturbed forests compared to eucalyptus forest lands which tend to be disturbed by agronomic activities, such as fertilization and weed control.

Although statistically the levels of organic matter are not significantly different, but qualitatively classified into different statuses. The level of organic matter in eucalyptus plantations is classified as moderate while in pine secondary forest is relatively low. This can happen because under the eucalyptus forest stands, there can be more intensive decomposition because it is more open and the soil temperature is relatively higher while in pine secondary forests where the land is more covered by plants below the decomposition process is lower so that the soil organic matter content is lower and litter more organic plant residues.

Table 1. Average soil chemical properties under stands of eucalyptus plantations and pine secondary forest in Aek Raja Village, ParmonanganSub District, Tapanuli Utara

Forest Soils	pH	Organic Material (%)	Organic Carbon (%)	N-Total (%)	P.avl (ppm)	K-exch. (me/100g)
Eucalyptus	5.03a (M)	3.73a (S)	2.16a (S)	0.57b (T)	13.68a (R)	0.43a (S)
Pinemerkusii	4.70b (M)	2.47a (R)	1.43a (R)	0.84a (ST)	14.15a (R)	0.42a (S)

Remarks: Average score followed by the same (small) letter notation in the same column is not significantly different based on DMRT test on p.05.

The uppercase letter in () is the qualitative value of the nature of the soil with M = acid; S = medium; R = low; T = high and ST = very high.

From Table 1 it can also be seen that the levels of P available for soil and K can be land exchange not statistically significant difference and also the same status qualitatively that is equally low for P available and medium for K can exchange between eucalyptus forest land and forest land secondary pine. The low levels of P-available and K can exchange land can occur because the soil at the study site is land that has a reliable nature which is dominated by allophan minerals which is strong in

absorbing P and also K. P levels are available and K can exchange land in these two types of land cover relatively the same as in open soil, both in the upper and lower layers (Table 2). Likewise with organic matter and soil pH.

Table 2. Average soil chemical properties in each soil layer in open land around eukaliputus forest in Aek Raja Village, Parmonangan District, NorthTapanuli District.

Depth Soil (cm)	N-Total (%)	P Bray II (ppm)	K-exch. (me/100g)	Organic Material (%)	Organic Carbon (%)	Soil pH
0-16	0.09 (SR)	15.00 (R)	0.48 (S)	4.2 (S)	2.44 (S)	4.7 (M)
16-29	0.09 (SR)	13.55 (R)	0.35 (S)	3.6 (S)	2.09 (S)	4.5 (M)
29-58	0.07 (SR)	14.75 (R)	0.49 (S)	2.0 (R)	1.16 (R)	4.6 (M)
58-77	0.12 (R)	17.45 (S)	0.34 (S)	1.2 (SR)	0.70 (SR)	4.5 (M)
>77	0.15 (R)	13.13 (R)	0.17 (R)	3.1 (R)	1.80 (R)	5.2 (M)

Description: SR = very low; M = sour; S = medium; R = low.

However, the total N-soil level in open soils (Table 2) was far (6.33 times) lower than the total N-level in soil under eucalyptus stands and 9.33 times lower than the total N-soil level below pine secondary forest stands. This proves that soil N is a nutrient that is not strongly bound by allophanmineral soils. The soil is reliable while soil P and K are relatively the same which means that these two elements are tightly bound/fixed by soil allophan minerals which have andic nature.

D. CONCLUSIONS AND RECOMMENDATIONS

Conclusion

1. Eucalyptus cultivation until the second generation in a andic soil Aek Raja Village, ParmonanganSubdistrict, Kabupaten North Tapanuli has no effect on the degradation of soil chemical properties, even the pH value is better than in the soil under the dominant secondary pine forest, except for lower N nutrients.
2. Eucalyptus cultivation until the second generation in a andic soil Aek Raja Village, ParmonanganSubdistrict, North Tapanuli Regency does not reduce P, K, and soil organic

matter, even the total N-soil content reaches 6.33 times greater than in open land .

Suggestion

The Andic nature of the soil for eucalyptus cultivation must be maintained by means of no tillage system (not peeled or scraped) so that the soil is not degraded (eroded and washed out of its nutrients).

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