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Phosphate-Solubilizing Microbe From Saprists Peat Soil and Their Potency to Enhance Oil Palm Growth and P Uptake

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ABSTRACT

Constraint of peat land utilization is low nutrent content. This research was conducted to determine the potency of phosphate solubilizing microbes (PSM) in solubilizing P yto increase the growth and P uptake of plant in peat soil. Based on their ribosomal DNA the best PSM were identified as Burkholderia gladioli nd Penicillium aculeatum that yield the highesr growth aphosphate uptake of oil palm seedling.

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Keywords: Peat soil, diversity, phosphate solubilizing microbe, Burkholderia sp, Penicillium sp

INTRODUCTION

Peat land is a land that is formed from plant debris pile that had decomposition and transport. Peat in the tropics generally is unique in the characteristics. Peat soil have high acidity, high organic matter, but low nutrient content. Peat land areas in Indonesia, covering 14.9 million hectares, are spread mainly in Sumatera, Kalimantan and Papua [17] with high variability in terms of thickness, maturity and fertility. However, only 9 million ha of it can be used for agricultural development. Based on the maturity level, peat is distinguished as: Saprists peat; Hemic and Fibric. Saprists peat is peat that has suffered the maximum decomposition (decay rate of more than 75%) with characteristic dark brown color. The blacker color of peat, the more fertile soil.

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The constraint of peat land for agriculture development is low nutrients content and high water table. Phosphate elements in peat lands were fixated by Fe or Al in the range of 0:17 to 0:33 phospholipids mg g^{-1} [3], so that it is not available and only 30% of them can be up taken by crops. Less nutrient of P uptake resulted in abnormal growth and low crop production [18]. Mineralization processes performed by microbes through organic acid production mechanism will enhance the availability of P. However microbe is affected by the pH, temperature and organic C content.

Naturally, microbes are available in abundance including types of bacteria, fungi and actinomycetes that affect of the soil health. Suriadikarta [21] mentions that *Bacillus subtilis*, *B. mycoides* and *B. mesentericus* can mineralize organic P (FePO4), Ca_3 $(PO_4)_2$, and solubilizing P glicerophosphate, lecithin and bone meal in vitro with the rate of 2-7, 3-9, 3-13, 5-21, and 14 percent, respectively. Further more Nenwani [14] reported that *Bacillus firmus* strain B 2 solubelize respectively 0.3, 0.9 and 0.3 percent compound Ca_3 $(PO_4)_2$ but not capable of dissolving $AlPO_4$ and $FePO_4$. Banik and Dey [2] mentions that the fungi is capable to solubilizing P in the form of $AlPO_4$ on acid soils, even higher than bacteria [12]; [11]; [9]. Its ability in P solubilized between 12 to 162 ppm in the Pikovskaya's medium containing $AIPO_4$ and relatively more soluble at 27-47% [13]. Availability of phosphate resulted in an increase in plant growth and yield [8], reducing the use of fertilizers [20] [23].

The information of phosphate solubilizing microbes at saprists peat has not been studied deeply. Therefore, this study aimed to determine the potency of P solubilizing microbe from saprists peat soil in order to improve the efficiency of fertilizer in peat land.

MATERIALS AND METHODS

This research was conducted at Pelalawan Regency Riau province from June 2013 to Mei 2014. Phosphate solubilization and soil analysis were done in Indonesian Vegetables Research Institute in Lembang, Bandung.

Material

Peat soil as sample was taken from Pelalawan saprists peat soil divided at 4 soil depths which are 0-30 cm; 30-60 cm; 60-90 cm and 90-120 cm, Pikovskaya's agar medium containing Al_3PO_4 and Ca_3PO_4 was obtained from CV Bangun Pratama, NaCl 0.85%, 90 - 95% alcohol, and germinated palm oil