UNIVERSITI PUTRA MALAYSIA

PHOSPHORUS FORMS AND ADSORPTION CAPACITY IN JAMBU SOIL SERIES

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PHOSPHORUS FORMS AND ADSORPTION CAPACITY IN JAMBU SOIL SERIES

By

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CERTIFICATION

This project report entitled Phosphorus Forms and Adsorption Capacity in Jambu Soil Series is prepared by SYAFFAF A'LIAH BT ZAINAL and submitted to the Faculty of Agriculture in partial fulfillment of the requirement of PRT 4999 (Final Year Project) for the award of degree of Bachelor of Agriculture Science.

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ABSTRACT

Phosphorus is often the most limiting plant nutrient, especially in tropical soils. Total P content in Malaysian sandy soil is hundred times lower than the other mineral soils. A study was conducted to study the forms of phosphorus and phosphorus adsorption capacity in the different horizons of Jambu soil series. Sandy soil of Jambu soil series were collected from Merang, Terengganu by Roslan et al.(2010) at different depths which were 0-15cm, 15-30cm, 30-45cm and 45-60cm. The soils were determined for the total P, available P, organic and inorganic P, and P adsorption capacity. The amount of P varies within the soil depths. Total phosphorus content in 0-15cm, 15-30cm, 30-45cm and 45-60cm depth were 6.42 mg/kg, 6.51mg/kg, 5.5 mg/kg and 5.08 mg/kg, respectively. The available P content increased with increasing soil depths which were 1.99 mg/kg, 2.35 mg/kg, 2.51mg/kg and 3.31 mg/kg. The amount of organic P and inorganic P depends on the amount of total P in the soil. The amount of inorganic P was higher than the amount of organic P. Based on adsorption coefficient (K_f value) obtained from Freundlich adsorption isotherm, the highest phosphorus adsorption was at depth 0-15cm, followed by 15-30cm, 30-45cm and 45-60cm.

ABSTRAK

Fosforus merupakan salah satu nutrient yang terhad kepada pokok terutamanya di negara tropika. Tanah pasir di Malaysia selalunya mengandungi fosforus seratus kali lebih rendah berbanding tanah mineral yang lain. Objektif kajian ini adalah untuk mengkaji bentuk fosforus dan kapasiti penjerapan fosforus pada horizon yang berbeza bagi tanah pasir Siri Jambu. Sampel tanah pasir iaitu Siri Jambu diambil daripada Merang, Terengganu oleh Roslan et al.(2010) pada kedalaman yang berbeza iaitu 0-15sm, 15-30sm, 30-45sm dan 45-60sm. Jumlah P di dalam tanah, P tersedia, organik P dan bukan organik P, dan kadar penyerapan P oleh tanah dikaji bagi setiap kedalaman tanah. Kandungan P adalah berbeza bagi setiap kedalaman. Jumlah kandungan P pada kedalaman 0-15sm, 15-30sm, 30-45sm dan 45-60sm ialah 6.42 mg/kg, 6.51 mg/kg, 5.5 mg/kg dan 5.08 mg/kg. Kandungan fosforus tersedia meningkat dengan peningkatan kedalaman tanah iaitu 1.99 mg/kg, 2.35mg/kg, 2.51 mg/kg dan 3.31 mg/kg. Jumlah organik P dan bukan organik P bergantung kepada jumlah keseluruhan P. Kandungan bukan organik P lebih tinggi daripada kandungan organik P. Berdasarkan isoterma penjerapan Freundlich, penjerapan P adalah paling tinggi pada kedalaman 0-15sm dan diikuti oleh kedalaman 15-30sm, 30-45sm dan 45-60sm.

CHAPTER 1

INTRODUCTION

BRIS soil is very common in Kelantan-Terengganu Plains. BRIS soil in Malaysia comprises about 0.5% of the total land area which is approximately 160,000 ha. BRIS soil comprises more than 95% of sand up to 150cm of the soil profile. The topsoil is dominated by coarse sand fraction while the subsoil is dominated by very fine sand (Roslan *et al.* 2010). BRIS soil is not economically suitable for planting crops due to their inherent poor fertility. Fertility of BRIS soil is inherently low due to low cation exchange capacity, CEC and water holding capacity, low pH (Roslan *et al*. 2010), low nutrient retention capacity and carbon content, and high aluminium toxicity and Phosphorus fixation.

P is often the most limiting plant nutrient, especially in tropical soils. Mahdi et al., (2011) stated that total P content in Malaysian sandy soil is hundred times lower than the other mineral soil which is only <100µ P/g (~200kg/ha). Phosphorus is important for plant because Phosphorus is involve in many plant processes which are energy transfer reactions, development of reproductive structures, protein synthesis, crop maturity and root growth. Based on Benton (1998), P in plant tissue is around 0.15 to 1.00%.

The orthophosphate, $H_2PO_4^-$ and HPO_4^{2-} are the primary forms of Phosphorus taken up by plants (Hinsinger, 2001). Phosphorus is not available for plants when phosphate ions reacts with soluble Fe and Al in the soil forming insoluble P. This mechanism is called P fixation. According to Jones (1982), not all of the phosphorus content in soil are available for plant uptake because most of the phosphorus is in the form that is difficult to utilize. Brady and Weil (2002) stated that the sufficient available P in soil solution for optimum growth in most plants is about 0.2 mg/L.

Organic P and inorganic P are the two main forms of phosphorus in the soils and the important P source for optimum plant growth. The organic P is usually found in humus and other organic materials. Inorganic P is found in various combinations with other elements which most of the form are not soluble in water. Although organic P and inorganic P are important sources for plant growth, their availability are controlled by soil characteristics and environment conditions.

Thus, the study was undertaken with the following objectives:

i. To study the forms of Phosphorus (Total P, Available P, Organic P and Inorganic P) in Jambu soil series.

ii. To study the Phosphorus adsorption capacity in the different horizon of Jambu soil series.

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