ABSORPTION OF Ca, K, Mg AND Na IN CORN ON THE OMBREGENOUS PEAT AS AFFECTED BY VOLCANIC ASH AND FLYING ASH

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ABSTRACT

A pot experiment was conducted to investigate effect of volcanic ash and flying ash application on absorption of Ca, K, Mg and Na by corn hybrid C-1 on the ombrogenous peat (pH± 3.36, Al-exch 0.697 me% and H-exch 52.116 me%) from Pontianak., West Kalimantan. The treatment was arranged in 6 level (0, 10, 20, 30, 40 and 50 % by weight), in 3 replications. The results indicated that application of the volcanic ash and flying ash increased the corn growth. Shoot and root dry weight increased significantly with increasing amendment rate, but no significant effect of the soil amendment type. Uptake of Ca, K, Mg and Na in leaves, stem, roots and whole plant of maize are increased significantly with increasing amendment rate. The amount of cations which are mostly absorbed, and distributed in leaves was potassium (K), then followed by Mg, Ca and Na, but in the stem, the sequence were Mg > K > Ca > Na, and in the roots, were Na > K > Mg > Ca (for the volcanic ash treatment), and Na > Ca > K > Mg (for flying ash treatment), respectively. Almost all of the coefficient of correlation between Ca, K, Mg and Na absorption in whole plant and the soil amendments rate are significant, except for the relationship between the flying ash treatment and Na absorption.

Keyword: *Ombrogenous peat, corn, volcanic ash and flying ash*

INTRODUCTION

Indonesia is a tropical country which has the widest peat in the world (± 27 millions ha). A large part of peat in Indonesia is oligotropic peat and just a small part of peat is mesotropic and eutropic (Dressen .and Soepraptohardjo, 1974). Generally, the ombrogenous peat of Indonesia has acid reaction (pH-H_20 around 3,5 - 4,5), poor in nutrient and cation exchange capacity (CEC) is about 60- 240 me % (Dressen, 1978). The high CEC value of the ombrogenous peat is the result of the high content of functional group in organic acids, such as COOH, OH etc. Nevertheless, the macro nutrient content is relatively low.

The characteristic of peat is very different from mineral soils, therefore, the management needed is also different. According to Donahue *et al.* (1977), the management practice for peat is consisted of three important stages, namely 1). drainage 2). liming to increase pH of peat and 3). supply of nutrients to increase their fertility. But, the effort to overcome this problem with

liming and fertilizer application is very costly. Therefore, attempts have been made to find an alternative that is cheaper, more effective and efficient. The use of natural goods (example: volcanic ash and flying ash) to improve the nutrient poverty is very rarely done.

The aim of this research is to observe how far the volcanic ash and flying ash are able to supply macro nutrients (Ca, K, Mg and Na) for plant growth on peat media.

MATERIALS AND METHOD

This experiment was conducted in a glass house. The peat was taken from Pontianak, West Kalimantan. Soil sampling was carried out at several points of a certain area and at the depth of 0 - 30 cm. After that, they were mixed to obtain a soil composite, and sieved by strainer with diameter of 5 mm. The indicator plant is corn hybrid C-1. The Volcanic ash was from Merapi Mountain and Flying ash was from PL TU Suralaya. Basal fertilizers used are Urea, TSP and KCL.

This experiment was arranged in completed randomized design, which consisted of 2 factors (Volcanic ash and Flying Ash). Each factor was made into 6 rates (0, 10, 20, 30, 40 and 50 %), and each treatment was made in 3 replications.

The chemical properties of soil measured were pH-H_20 and pH-KCI, organic matter contents, AI-exch, H-exch, Cations-exch (Ca^{2+}, K^+, Na^+ and Mg^{2+}), the total cations, effective CEC, and AI-saturation. The characteristics of amendment materials analyzed were pH-H_20 and pH-KCI, and the total cations (Ca^{2+}, K^+, Na^+ and Mg^{2+}) content. The plant tissue analysis was conducted using wet destruction method ($HClO_4$ 18 %) to see the total Ca^{2+}, K^+, Na^+ and Mg^{2+} content in leaves, stem and roots. The analysis of data was carried out by using MSTAT program for getting ANOVA and DMRT.

RESULTS AND DISCUSSION

Chemical properties of the peat and soil amendments

The chemical properties of the peat are presented in Table 1, and the chemical properties of Volcanic ash and Flying ash are in Table 2.

The acidity of this peat is very high because this soil is predominated by organic acids. Therefore, the exchangeable hydrogen content is higher than the exchangeable Al^{3+}. The exchangeable H^+ comes from organic acids, and the greater part of aluminum in the soil form ligand with organic matter, so the exchangeable Al^{3+} content is low. The advantage of this condition is that there is no problem with aluminium toxicity. The organic matter content in this soil is about 44.16%. The height of the organic matter can be used to store cations in the adsorption complexes.