ABSTRACT

DEDI NURSYAMSI. Release of fixed potassium by adding oxalic acid and cations to increase available potassium for plant growth on smectitic soils (under supervision of KOMARUDDIN IDRIS as chairman, and SUPIANDI SABIHAM, DJUNAEDIS ABDUL RACHIM, and AGUS SOFYAN as members of the committee).

Research aimed to study the role of oxalic acid, $\text{Na}^+$, $\text{NH}_4^+$, and $\text{Fe}^{3+}$ in increasing available K in smectitic soils for maize ($\text{Zea mays, L.}$) were conducted in Laboratory of Soil Science, Kyoto University, Laboratory of Research and Soil Test, and Green House of Indonesian Soil Research Institute, Bogor. The experiments used 91 of composite soil samples taken from Java that represented Inceptisols, Vertisols, as well as Alfisols. Four bulk soil samples taken from Jonggol, Bogor (Typic Hapludalfs), Sidareja, Cilacap (Chromic Endoaquerts), Padas, Ngawi (Typic Endoaquerts), and Todanan, Blora (Typic Haplustalfs) were also used in the experiments. The results showed that most of K in the smectitic soils was in non-exchangeable form, thus it was not available for plant growth immediately. Clay, organic-C, and smectite content as well as CEC significantly affected on availability of soil K, where the higher the variables the higher the potential availability of soil K for plant growth. Oxalic acid was found out as dominant organic acid excreted from maize roots, it was about 3.15 – 5.93 mg/g DW. Among the cations, soil buffering capacity and maximum sorption were in order of $\text{Fe}^{3+} > \text{NH}_4^+ = \text{Na}^+$, while bound energy constant was in order of $\text{Na}^+ > \text{Fe}^{3+} > \text{NH}_4^+$. Among the soils, the soil buffering capacity and maximum sorption on the cations was in order of Vertisols > Alfisols. Oxalic acid, $\text{Na}^+$, $\text{NH}_4^+$, and $\text{Fe}^{3+}$ significantly released fixed K, increased basal distance of smectite, and increased availability of soil K in all tested soils. Rate of 1000 ppm of oxalic acid increased availability of soil K so that decreased the requirement of K fertilizer as well as increased dry biomass yield in both Chromic Endoaquerts and Typic Endoaquerts. Rate of 125 ppm of $\text{Fe}^{3+}$ also increased plant N, P, and K uptake as well as increased dry biomass yield in the soils. Rate of 85-96 ppm of $\text{NH}_4^+$ also increased the availability of soil K so that decreased the requirement of K fertilizer in both soils.