

Xaysatith Souliyavongsa 2010: Phosphorus Requirements for Maize in Ultisols of Xiengkhouang Province, Lao PDR. Master of Science (Soil Science), Major Field: Soil Science, Department of Soil Science. Thesis Advisor: Professor Tasnee Attanandana, D.Agr. 79 pages.

The Ultisols of Xiengkhouang Province are very strong acid soils, so the phosphorus (P) deficiency is the serious problem in this area. The P requirements for maize in Ultisols of Xiengkhouang Province, Lao PDR were quantified based on the terms in the Phosphorus Decision Support System (PDSS) equation. The Phosphorus Buffer Coefficient (PBC), an important factor in this equation, quantifies the reactivity of the soil with P that has been added to the soil. Based on data from South America, the PBC is estimated by its relationship with percent clay. This estimation might not be appropriate for different soils in Laos. This study was comprised of 3 experiments: 1) Determine the Phosphorus Buffer Coefficient (PBC) of 15 representative maize soils of Laos from which P was extracted by three different methods; Bray 2 ($PBC_{\text{Bray 2}}$), Mehlich 1 ($PBC_{\text{Mehlich 1}}$) and the Pi test ($PBC_{\text{Pi test}}$). The soils were incubated with KH_2PO_4 at the rate of 0, 25, 50, 100, 200 and 400 mg P kg^{-1} for two weeks, the amount of P extracted was plotted against added P and the slope of the curve (the PBC) was determined. The results showed that the $PBC_{\text{Bray 2}}$ values were higher than those of $PBC_{\text{Mehlich 1}}$ and $PBC_{\text{Pi test}}$ for all soils. $PBC_{\text{Bray 2}}$ and $PBC_{\text{Mehlich 1}}$ were highly correlated with organic carbon, Fe_d and clay and could be predicted with an AdjR^2 of 0.79** and 0.86**, respectively. The $PBC_{\text{Pi test}}$ was correlated with Al_o , clay and organic carbon and could be predicted with an AdjR^2 of 0.80**. 2) Quantify the P sorption of potential maize soils of Laos. The results indicated that soils with higher clay, Fe and Al contents sorbed higher amounts of P and desorbed lower amounts of P. The P requirement determined by P sorption isotherms using P in soil solution at equilibrium points of 0.06 and 0.2 mg P L^{-1} ($\text{PS}_{0.06}$ and $\text{PS}_{0.2}$) was very high compared to the P requirement estimated from the PDSS equation for Bray 2, Mehlich 1 and the Pi methods. The third thesis component (3) Determine the necessary amounts of P and Zn needed for commercial maize production in Xiengkhouang province. A field experiment was conducted in an Ultisol near Mee village, Pek district of Xiengkhouang province. The soil was very acid, and P deficiency severely restricted maize growth in the soil as indicated by a diagnostic greenhouse experiment. The field study revealed that after the application of 3.8 T ha^{-1} of $\text{Ca}(\text{OH})_2$ lime, and P application at the highest rate of 56 kg P ha^{-1} with 4.72 kg ha^{-1} $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ gave the highest yield of 5,735 kg ha^{-1} and gave a net return of US\$ 290 ha^{-1} . With only the application of lime and the highest P application, (without Zn) yields were 4,418 kg ha^{-1} and the net return was US\$ 88 ha^{-1} . The P fertilizer might have been inadequate for this area at the highest rate of application, because maize showed P deficiency symptoms during growth. The PDSS equation predicted the P requirement of the Pek soil at the site may be higher than 56 kg P ha^{-1} when compare to the result of field experiment.

Student's signature

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