Phosphate Rock Dissolution and Availability in Some Soils of Semi-deciduous Rainforest Zone of Ghana

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Abstract

Alfisols and Ultisols of the semi-deciduous forest zone of Ghana are known to be moderately acid and very low in plant available phosphorus (P). These soils need to be fertilized to increase crop production but due to economic reasons local farmers are unable to afford water-soluble P fertilizers. Instead of expensive superphosphates, the use of less expensive phosphate rocks such as Togo rock phosphate (TRP), Gafsa rock phosphate (GRP) and 50% partially acidulated rock phosphate (PAPR) are possible alternative P sources for these soils. The rate of dissolution of TRP, GRP, PAPR and TSP in three benchmark soils of Ghana was assessed, and the effectiveness of these P sources determined in a greenhouse using maize (*Zea mays* var. Toxpino) as a test crop. The dissolution of the P sources in three soils Bekwai, Nzima (Ultisols) and Kokofu (Alfisol) along a toposequence was investigated in an incubation study and also in a greenhouse experiment. The rate of dissolution of the P fertilizers was determined in the laboratory by extracting with anion exchange resin membrane (AEM), 0.1*M* NaOH and 1*M* HCl at 21 days interval for 105 days. In the greenhouse study, each P source was added at the rate of 60 mg P kg^{-1} soil, and sown to maize (*Zea mays*. var.Toxpino) for 28 days. The results of the incubation study showed that the amount of P extracted by the AEM and HCl, following the addition of the P sources, decreased with incubation time in all three soils. However, there was an increase in NaOH-P in all the three soils as incubation progressed. The increase in the NaOH-P suggested that the dissolved P was adsorbed by Fe and Al oxides. The greenhouse results showed that dry matter yield was in the order TSP = PAPR > GRP > TRP. Relative to TRP, the PAPR and GRP were reactive enough to provide plant available P to satisfy the early P requirement for maize growth. Togo PR has little potential for direct application in the three soils.