

Abstract

The low availability of phosphorus (P) in the oxisols of western Kenya is a major constraint to crop production. Some legume genotypes possess stress response mechanisms that enhance their ability to access P in low P soils and may be useful components for integrated soil fertility management in these soils. In this study, a characterization of the spatial variability of soil properties was first assessed through geo-statistical analysis. Some selected legumes including three non P responder species, pigeon pea (*Cajanus cajan*), white lupine (*Lupinus albus*) and groundnut (*Arachis hypogaea*) and two P responders, soybean (*Glycine max*) and Lablab (*Lablab purpureus*) were evaluated for their performance in soils that had different management histories and levels of fertility degradation. Phosphorus dynamics and adsorption following incorporation of the legume residues were measured, and the effect of the legumes on growth and nutrient uptake of maize (*Zea mays*) determined. Greater anion exchange membrane (AEM) P values were obtained in less degraded soil. Plant residue addition depressed AEM P in the highly degraded soil but increased it in the less degraded soil. Legume crop residue input generally led to microbial immobilization of P. The most degraded soil adsorbed more than twice the amount of P adsorbed by the non-degraded soil. Residues of maize and soybean but not white lupin, reduced P adsorption. There was no site effect on legume biomass production and P uptake in the field, but in a pot study, non P responders performed better in the medium fertility soil while P responders showed higher performance in high fertility soil. White lupine had the lowest biomass while lablab offered the highest potential for both biomass and grain production. Maize produced more biomass and higher grain yields and had a higher nutrient uptake when grown in association with or after legumes than sole or after maize. These results show a promising potential of the studied legumes to contribute to P management in the nutrient depleted cropping systems of western Kenya. It was apparent that the benefit of the legume crops on soil nutrient availability and maize growth depended on the initial soil fertility status