Combining organic and inorganic amendments to improve maize growth and phosphorus availability in phosphorus deficient soils in Kenya

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Phosphorus (P) deficiency is one of the main biophysical constraints for crop production in soils in western Kenya. The use of mineral fertilizers provides a solution to reverse the predominant P deficiency. Because chemical fertilizers are often not within socio-economical reach of smallholder farmers, they use organic materials such as biomass, manures and compost as alternative nutrient sources. Since the P content of plant residues and manures are normally insufficient to meet crop requirements, combination with inorganic P fertilizer is recommended. Apart from providing P, organic fertilizers are expected to have additional positive effects on P availability through changes in soil characteristics otherwise constraining soil P availability. For example, an increase in soil pH will favor P availability to crops in acidic soils. Also, organic anions resulting from decomposing residues can bind some metals such as Fe and Al responsible for P sorption. Understanding the processes behind the beneficial effects of organic resources to enhance P availability and plant growth will contribute to the development of appropriate technologies.

In this research two different types of organic inputs were tested: farmyard manure (FYM) and *Tithonia diversifolia.* Because the quality of organic materials used has been shown to impact the improvement in P availability (Nziguheba et al. 2002), a high and low P input was selected for both organic materials (P contents were 0.48 vs 0.2 % P for *Tithonia* and 0.82 vs 0.21 % P for FYM). In a greenhouse trial of 6 weeks, two soils representative for P deficient soils in the area (Kuinet and Sega) were selected. The P rate of 216 mg P kg^{-1} was selected to test positive substitution effects. 0, 25, 50, 75 and 100% of the TSP as then replaced by an organic P input, still maintaining the target P rate of 216 mg P kg^{-1}.

Both soils proved to be responsive to P applied, with yields increasing up to 432 mg P kg^{-1} applied. The substitution 25 % low P *Tithonia* and 75 % TSP shows a positive substitution effect in both soils. In general, yields are little affected by substitution rate when high P FYM or high P Tithonia is used. Application of low P organic inputs at 100 % resulted in yields below the potential of 100 % TSP. These results implying that the quality of organic materials used are important.