

PREP-PAC: a nutrient replenishment product designed for smallholders in western Kenya

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Abstract:

Continuous cropping in the absence of external nutrient inputs to soils has led to the expression of poorly productive patches in farmers' fields of western Kenya. Farmers attempting to correct these conditions are often confused by the spatial and symptomatic irregularity of affected plants and, until recently, no soil management product was commercially available that is specifically formulated to restore soil fertility to these patches. PREP-PAC consists of 2.0 kg of Minjingu rock phosphate (RP), 200 g of urea, seeds of various symbiotic nitrogen-fixing food legumes, rhizobial inoculant, gum arabic seed adhesive, lime for seed pelleting, and instructions for the use of these materials. It is intended for addition to 25 m² and produced at a cost of \$ 0.56 per unit. The general principle is to apply slowly available RP sufficient for several cropping seasons with readily available nitrogenous fertilizer and to intercrop farmer's maize (*Zea mays*) with a legume that provides residual fixed-nitrogen and organic inputs to the soil. This approach was tested in on-farm experiments conducted in collaboration with several grassroots rural development organizations. An experiment examined interactions between PREP-PAC components in a maize–soybean (*Glycine max*) intercrop in nutrient-depleted soils with sandy and clayey surface horizons. The treatments included \pm RP, \pm urea, and \pm inoculants arranged as a 2³ factorial with four replicates at each location. Total value of the intercrops ranged between \$ 0.83 in the unamended plots and \$ 2.44 in plots treated with PREP-PAC. Significant positive effects were observed with the addition of RP ($P < 0.001$), urea ($P = 0.04$), and inoculant ($P = 0.01$) and in interactions between RP and urea ($P = 0.02$) or inoculant ($P = 0.07$). The return ratio to PREP-PAC investment was 2.6 in the sandy soil and 3.7 in the clay. PREP-PACs were tested on-farm in 52 symptomatic patches containing maize–bean intercrops with and without an improved variety of climbing *Phaseolus vulgaris* cv. Flora. Unamended patches (View the MathML source ha) produced 1.6 kg maize and 0.08 kg bean. With addition of PREP-PAC containing Flora, yields increased to 4.1 kg maize and 1.1 kg bean ($P < 0.001$ for both crops). Improvement in bean yield during the first cropping season nearly offset PREP-PAC's investment costs. PREP-PAC is a strategic approach because all of its ingredients, except for urea, originate from East Africa, and are relatively inexpensive; the product is intended for distribution through existing retail and development networks.