

A-07

Assessment of balanced nutrient management requirements for soybean intensification in sub-Saharan Africa

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Improved understanding of effects of inoculation and balanced nutrient management on soybean productivity and nitrogen fixation under highly variable soil fertility conditions is an important step to reverse low yields on smallholder farms in sub-Saharan Africa. Multi-location nutrient omission trials were conducted in Kenya and Uganda to assess the effects of inoculation and N, P, K, S and micronutrients on productivity of soybean. Additional manure and lime treatments were added to the full fertilizer treatments to evaluate the effects of integrated nutrient management. In Uganda, mean soybean grain yield was 0.85 t/ha in the control plots and increased significantly to 1.8 t/ha with application of inoculum and NPK basal fertilizer. Yields were further significantly increased to 2.2 t/ha with additional application of S and micronutrients. Maximum yield of 3.8 t/ha were obtained when manure was added to the full fertilizer treatment. In Kenya, yields in control plots ranged substantially from 0.1 t/ha in degraded soils to 2.4 t/ha in fertile soils that had received large additions of manure in the past. In the degraded soils, inoculation had no effects on soybean yields, and yields were only increased to a maximum of 0.5 t/ha in the full fertilizer treatment. However, yields were significantly increased to 1.3 t/ha when lime and manure were applied to the full fertilizer treatments. On the fertile fields, maximum yields of 2.5–3.6 t/ha were achieved with the full fertilizer treatments. The results from the experiments highlight good potential for soybean production intensification with balanced nutrient management in fertile soils. In degraded soils, application of manure, lime and other organic resources in addition to fertilizer is necessary to significantly increase soybean yields.