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Implications of Resource Management on Soil Fertility in Common Farm Types in Kakamega, Western Kenya

Thuweba Diwani, Mathias Becker, Frank Mussgnug

University of Bonn, Institute of Crop Science and Resource Conservation (INRES) - Plant Nutrition, Germany

Abstract

Kakamega in Western Kenya is dominated by a diversity of smallholder farming systems characterised by intense cultivation with little external input use, resulting in declining soil fertility and crop yields. Technologies to counteract these constraints are rarely implemented, as they do not consider the diverse farming systems, their access to and application of nutrients to crops and the resulting influence on soil parameters. Thus, studying nutrient fluxes and balances and their effect on soil fertility after classification of farms is a prerequisite for successful targeting of interventions.

In a three-year on-farm study, plot level nutrient balances and resource fluxes between farm components were established in 18 farms of six major types. These ranged from subsistence- to highly market-oriented systems and were located on two soil types. Soil chemical parameters were also determined from some 90 fields under different management.

Subsistence farmers applied little inputs to maize (<9 kg N and 11 kg P ha^{-1}) and attained the lowest yields (0.6 kg ha^{-1}). Market-oriented farmers, who applied large amounts of animal manure, obtained the highest maize yields. Commercial farmers on Ultisols applied most mineral N to tea, while subsistence farmers applied most organic amendments to home gardens. Consequently, nutrient balances strongly differed between farms and among farm components. Mineral fertiliser use was insufficient to balance nutrient removal by maize, whose fields were strongly depleted (-81 kg N and -86 kg K ha^{-1}).

Soil type and nutrient allocation influenced soil fertility attributes. Alfisols contained less N (0.15 %) and C (1.79 %) than Ultisols, which were characterised by low extractable P (<8 mg kg ha^{-1}). The poorest soils occurred under maize, irrespective of the farm or soil type, whereas home gardens were more fertile.

Production constraints and nutrient management strategies vary among farm types and components and account for large differences in soil fertility. To be adoptable, soil improvement technologies must address system-specific constraints and fit farm attributes. The combination of a farm typology, nutrient balances and soil analyses are seen to improve the targeting of these technologies to specific socio-ecological niches within Kakamegas diverse farming systems.

Keywords: Kenya, nutrient balances, nutrient fluxes, smallscale farming sytems, soil N P K

Contact Address: Thuweba Diwani, University of Bonn, Institute of Crop Science and Resource Conservation (INRES) - Plant Nutrition, Karlrobert-Kreiten-Strasse 13, 53115 Bonn, Germany, e-mail: thuwebadiwani@yahoo.com