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Implications of Differential Nutrient Flux Management on Soil Fertility and Crop Productivity in Major Farm Types of Kakamega, Kenya

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Abstract

Small-scale farms, ranging from subsistence to market oriented production, dominate the agricultural matrix in Kakamega District in Kenya. Main components of most of these farms are field crops, dominated by maize-bean intercropping, home gardens with fruit trees and vegetables, and forage production patches. An additional feature of the market-oriented farms is the production of industrial crops such as tea (predominant on Ultisols in the south of the district) and sugarcane (predominant on sandy Alfisols in the north of the district). Variable soil fertility and declining crop yield trends have been recorded during the past decade and were associated with land use intensification in the absence of external input use and a poor crop residue management. In two-year on-farm observation trails in 16 representative farms, the large spatial variation in soil fertility, both within and between farms, was studied. Resource flow mapping was related to crop yield and soil fertility. Farms were classified into two categories: **(1)** small, largely subsistence-oriented farms with maize yields $< 1 \text{ Mg ha}^{-1}$ and **(2)** larger market-oriented farms with diverse crops and usually maize yields exceeding 1.5 Mg ha^{-1} . In each of the major soil types (Alfisol and Ultisol) four farms of each category were selected (16 farms). Nutrient balances (N, P, K) at farm and plot level and resource flow maps (inputs, products, labour) were established and linked to soil fertility descriptors (org. C fractions, pH, avail. P). Additionally, the effects of selected soil fertility-enhancing technologies (mineral fertiliser use, application of farm yard manure and *Tithonia diversifolia*, and leguminous live-mulches) on nutrient flows and budgets were evaluated. Data were analysed by the NUTMON model in view of evaluating resource base quality scenarios and to define and target site and system-specific intervention strategies.

Keywords: Bean, Maize, NUTMON, Resource flow mapping, Tithonia