Abstract

Spatial variability in soils occurs naturally from pedogenic factors, but it can also occur as a result of land use and management. Often the net effect of different soil management options and combinations and social variation, over the long run, is the gradual build up of nutrient rich micro-niches rather than a gradual decline in fertility over a wider area. Soil management practices that have often been generalized to the farm level may not be transferable between crops or locally perceived land use types and tend to portray that change within farms, communities or farming landscapes are homogeneous in their outcomes while obscuring important social and spatial heterogeneity. The objective of this study was to assess farm spatial variability in soil fertility under intensive cropping and determine the relationships between the variability and household socio-economic status. Socio-economic data were collected through a survey of 125 randomly selected households using structured questionnaires in a densely populated area of the western Kenya highlands. The area is part of the mixed crop/livestock farming system in Vihiga district where Ultisols and Oxisols, constitute 75% of the soils Jaetzold and Schmidt (1982). Soil data were obtained by both chemical and Near Infra-red (NIR) spectral analysis of topsoil (0-20 cm) samples that were taken from each identified land use/cropping type in each of the surveyed households. Spatial variability was assessed through the analysis of scaled semi-variograms of the selected individual variables and examination of kriged maps that were obtained in GS+. Statistical and spatial analyses were performed in S plus, and ArcGIS respectively. Principle components analysis was done on the spectral data and the first principle component (PC1) was selected for further analyses. Despite significant correlations between the soil properties, they displayed different spatial variations. PC1 fitted the same model (Gaussian) as clay and was correlated to all the soil properties. The soil properties showed moderate spatial dependence. The semi-variance of C displayed the largest range indicating that C values influenced neighbouring values of C over greater distance. PC1 displayed the largest proportion of structural variance indicating a better spatial dependence than the rest of the properties. This spectral component was most closely associated with C, N and P and was therefore used as a spectral fertility indicator. All the proportions of structural variance were greater than 50% indicating that the variances were moderately well described by the lag distance. Kriging maps of the soil variables and PC1 showed different patterns of distributions. Spatial analysis showed that 73% of the households live on the most impoverished soils. Likewise, a large proportion of the households (84%) are of low to medium socio-economic status. More than half of the households are of low to medium status and live on low to very low fertility soils. Further analysis showed that the distribution of the households across the landscape was more likely a phenomenon of chance (kappa = -0.015ns). However, regressions on soil properties, showed significant effects of crop output ($p=0.01$) and distance from the house ($p<=.05$), which imply household management effects. We conclude that household socio-economic status did not show any influence on the soil properties, but household management effects may be an important component in those villages irrespective of the household status.