

Assessment of soil and landform characteristics for implementation of conservation agriculture in West Usambara Mountains, Lushoto District, Tanzania

Kyaruzi, L.A.¹, Kimaro, D.¹ & Msita, H.B.¹

¹Sokoine University of Agriculture, P. O. Box 3005, Morogoro, Tanzania

Corresponding author: kyar75@yahoo.co.uk

Abstract

Developing strategies that promote conservation agriculture in the West Usambara Mountains in Tanzania poses a particular challenge. This research used empirical and qualitative method to assess soil and landform characteristics in relation to predominant five conservation agriculture practices on the landscape. Chemical and physical properties of composite samples (0-25cm) from terraces, miraba (a local technique), raised beds, fallow and fields with no conservation were determined. Results indicated that the differences in total nitrogen, organic carbon, base saturation, available phosphorus, CEC, and pH were statistically significant ($p=0.05$). In most cases 'miraba' had better values of CEC, P (Bry) and total nitrogen. Since construction of 'miraba' is far cheaper than terraces, efforts should be put towards improving this technique.

Key words: Lushoto, miraba, Tanzania, terraces

Résumé

Développer les stratégies qui favorisent l'agriculture de conservation dans les montagnes occidentales d'Usambara en Tanzanie pose un défi particulier. Cette recherche a employé la méthode empirique et qualitative pour évaluer des caractéristiques du sol et de la forme du relief par rapport aux cinq prédominantes pratiques en matière d'agriculture de conservation sur le paysage. Les propriétés chimiques et physiques des échantillons composés (0-25cm) provenant des terrasses, de miraba (une technique locale), des lits surélevés, de jachère et des champs sans conservation ont été déterminées. Les résultats ont indiqué que les différences en azote total, carbone organique, saturation de base, phosphore disponible, CCE et pH étaient statistiquement significatives ($p=0.05$). Dans la plupart des cas, 'miraba' avait de meilleures valeurs de CCE, du P (Bry) et de l'azote total. Puisque la construction du 'miraba' est de loin moins cher que les

terrasses, des efforts devraient être fournis pour améliorer cette technique.

Mots clés: Lushoto, miraba, Tanzanie, terrasses

Background

The West Usambara Mountains in Tanzania, are characterised by severe land degradation. This is due to the high population density encroaching marginal areas. Conservation agriculture can retard soil degradation. In Tanzania, several conservation agriculture programmes have not yielded satisfactory results due to scanty information in changes in soils and landforms characteristics where conservation practices have been practiced.

Literature Summary

In South America, where millions of hectares of farmland have been under conservation agriculture, several studies have reported gains (IRR and ACT, 2005; Derpsch, 2005; Bollinnger *et al.*, 2006). The gains have been attributed to land quality improvement (Fabrizzi *et al.*, 2005). In Sub-Saharan Africa conservation agriculture has been restricted only to large estate farming (IFAD/FAO, 2004) and the practice remains poorly adopted among the small-holder highland farming community (Tenge *et al.*, 2003). Conservation agriculture can control soil erosion, reverse land degradation, give more stable yields and reduce labour and fuel needs (IFAD/FAO, 2004).

Study Description

Research was conducted on farmers' fields in Migambo sub catchment West Usambara in 2009/2010. The altitude is above 1510 meters with cool but dry climate. Rainfall is bimodal with an average of 800 – 2000 mm per annum in the Highlands.

Aerial photographs were integrated with DEM in GIS to produce base. Transect soil augering was done across landforms in order to establish soil. Georeferenced representative soil profiles were described according to FAO (2006). Composite samples (0-25cm) were taken from identified conservation agriculture fields for determination of soil fertility status. Semi structured questionnaire was used to collect information on characteristics of conservation agriculture such as fertility management and socio economic.

Research Application

Profiles indicated variation of soils with landscape position. Textures indicate higher proportions. Chemical and physical properties revealed slightly acidic to strongly acidic soils, medium CEC, very high exchangeable calcium, medium to high

exchangeable magnesium, low exchangeable sodium and high available phosphorus. Organic carbon and total nitrogen were higher in the valleys due to manuring and trash. Local 'miraba' technique and fallowing indicated better fertility status.

Recommendation

It is recommended to continue with 'miraba' technique because this has proved to be better than terracing in terms of soil fertility parameters, besides 'miraba' is based on indigenous knowledge which can be easily improved and sustained.

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