

Bridging Research and Development in Soil Management: Matching Technical Options with Local Livelihoods

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Abstract: Practical approaches are needed to assist local professionals in reversing land degradation, especially in marginal, hillside environments such as occur in Eastern Uganda. In particular, methodologies are required to enable the choice of soil management options to be better targeted to specific biophysical environments, cropping systems and client farmer groups.

Based on participatory surveys of farming systems, natural resource endowments and rural livelihoods in the districts surrounding Mount Elgon, eastern Uganda, local farmers are examined in their varying access to livelihood assets, how they perceive soil problems and what soil management techniques they actually use. It was found that there is obvious variation between households in their access to the factors of production and livelihood strategies they adopted, and this variation has affected soil management practice in a number of ways. Farmers perceive soil erosion and declines in soil fertility as one of a number of constraints to crop production. The resources a farmer devotes to soil management also depend on the magnitude of other production and livelihood constraints.

Using this basic livelihoods information, the gaps between existing techniques/information and actual needs perceived by farmers are discussed. Farmers are more interested in the measures that provide quick returns with least inputs or where the needed inputs are locally available. For example, all surveyed farmers mulched their banana plantations with banana leaves, while fewer than 10% practised terracing on their fields. Farmers' interests in potential interventions are variable depending on their perceptions of constraints and resources available, including grass strips for erosion control, mulching for moisture conservation and composting mainly for nutrient improvement.

Finally, the entry points and pathways by which the practical approaches and methodologies could be developed are illustrated with reference to the dynamics of soil management and rural livelihoods. A framework to link soil management to local livelihood is being developed to guide the identification and fine-tuning of appropriate soil management options.

Keywords: soil management, technical options, sustainable livelihoods

1 Introduction

The widespread failure in adoption of promoted soil management measures has stimulated great interest in the adoption process itself (e.g. Baum *et al.*, 1993) and the ways in which extension workers and other local professionals (LPs) operate in the field. The identified reasons for poor adoption are many but it is commonly reported that recommended techniques are not well matched to local conditions and are unable to address the priorities of local people (Hudson, 1991; Bunch, 1999). In response to this, a singular focus on good soil management has been replaced by the broader objective of good 'land husbandry' comprising sound land use practices and farming methods and better livelihoods for the land users (Hudson, 1992; Shaxson *et al.*, 1987; Shaxson *et al.*, 1997).

The most recent efforts in soil management combine the concepts and principles of land husbandry with the sustainable rural livelihoods (SRL) approach currently pursued by DFID (UK Department for International Development) and other international donors and development agencies (Carney, 1998;

Farrington *et al.*, 1999; Scoones, 2001). A SRL can be measured against its expected outcomes: more income, improved well-being, reduced vulnerability, improved food security and more sustainable use of the natural resource base. The application of the SRL approach in soil management provides a broad and holistic framework to understand in what context (in terms of policy environment, history, agroecology and socio-economic conditions) farmers draw upon a given set of livelihood resources (the different capital assets) and follow particular livelihood strategies (agricultural intensification, livelihood diversification, migration etc.) to achieve their desired livelihood outcomes (Scoones, 1998).

In the real world farmers' livelihoods are complicated and often very diverse, even within a single community. Part of this complexity can be attributed to differences between households in each of the livelihood elements outlined above, but the degree to which important aspects or determinants of livelihoods can change also contributes to their complex and dynamic nature. Traditional approaches to research and development in soil management often failed to capture this diversity and dynamism and this partly explains the frequent mismatches between management options generated by research and the needs of farmers and local professionals working with soil management. The problem of mismatch may be in format where research outputs are published in journals or other forms inaccessible to farmers and local professionals (LPs). It may be in resolution where blanket recommendations are not sensitive to different location or farmers. Alternatively, it may be in flexibility, where research generated options are too inflexible to adapt to diverse and changing conditions. Approaches and methodologies are needed to allow LPs to overcome these problems and enable the selection of soil management options to be better targeted to specific biophysical environments, cropping systems and farmer groups.

Once the local complexity is acknowledged the assumption follows, perhaps too readily, that it must be studied and understood in order to target advice on soil management to specific farmers or farmer groups. If this is so then the LPs, already resource constrained and under pressure to be more participatory, holistic, cross-sectoral and multi-skilled, faces an impossible job. Few have the skills and resources to engage in sophisticated livelihood analyses and then analyze, interpret and use the findings.

Alternatively, a more empirical approach may be suggested, based less on a sophisticated analysis of the farmer and community but more on a process where farmers experiment, trying things out which interest them. This is supported by the LP where both are guided by a relatively rapid analysis that identifies the environmental and socio-economic 'ball-park' in which the farmers are operating. It is this alternative approach that is being developed in this research.

2 Methods

2.1 The study area

The study was carried out in the districts of Mbale and Kapchorwa in the Mount Elgon area, of Eastern Uganda. The area is 1,200—1,500 meters above sea level; most of the landscape is steeply sloping and dissected by many valleys. Much of the soil is derived from volcanic parent material with high original fertility, but this has degraded rapidly in the last two decades. The rainfall pattern is unimodal with mean annual totals of over 1,200mm per year. Rainfall peaks in April and May and is generally more than 100 mm per month from March to November. The major crops are cooking bananas, maize, bean, cassava, yam, while coffee is the main cash crop.

2.2 Data collection

The objective was to understand farmers' perceptions of soil erosion and fertility decline; the rationale behind their soil management activities; and the demand for support in this area from different wealth categories of farmers. A number of participatory methods were used in data collection, including key informant interviews, focus group discussions, wealth ranking, resource flow mapping and semi-structured interviews. Eight villages were chosen representing different cropping systems, land-use intensity and type/degree of soil related problems. Four were chosen for detailed household surveys with 35 households sampled in each; focus group discussions only were held in the other four villages. The household questionnaire survey included questions on access to resources important for production; awareness of soil problems in relation to crop production; and responses to the perceived soil problems.

The focus group discussions concentrated on trends in production and soil degradation in the village; the underlying reasons for soil degradation, as perceived by farmers; and the costs and benefits of adopting improved soil fertility management techniques as assessed by farmers.

3 Diversity of rural livelihoods

In the SRL framework, the livelihood assets are categorised into five capitals: natural, physical, financial, human and social (details see Carney, 1998; Scoones, 1998). Most technical options for soil management involve expending these resources in some way (e.g. land, labour, capital, and techniques). Thus there is usually a relationship between farmers' access to the resources and their soil management practices. It follows, therefore, that farmers may manage their soil differently depending on their available resources and that advice for improved soil management should differ accordingly. Therefore, the diversity of local livelihoods, the ways farmers get access to livelihood assets, their perceptions on soil degradation and the current and expected technical options for soil management are all vital aspects that need to be considered.

3.1 Access to assets

3.1.1 Wealth status

Farmers were first categorised into different wealth status groups - rich, medium and poor - by using wealth ranking based on locally identified criteria (Table 1). The criteria are comprehensive and multi-dimensional including not only the access to different assets but also the livelihood strategies. The rich farmers have better access to natural and physical assets, better education and have more access to information and new techniques. Therefore rich farmers can combine and trade-off their assets to pursue more diversified livelihood strategies. In contrast, due to limited access to natural, physical and human assets, poor farmers follow simpler livelihood strategies and are less able to employ trade-offs between different assets to help them engage in new activities.

Table 1 Criteria for wealth status Classification

	Districts	Criteria
Kapchorwa	<ul style="list-style-type: none"> • Land area • Kinds of crops and management level 	<ul style="list-style-type: none"> • Number of cows • Quality of housing • Age and family composition
Mbale	<ul style="list-style-type: none"> • Land area • Kinds of crops and the area of each crop • Off-farm activities • Number of cows 	<ul style="list-style-type: none"> • Level of education and attendance at study seminars and workshops • Quality of housing • Ability to pay for education of their children

3.1.2 Access to land and labour

It has been argued that one of the preconditions for adopting soil conservation and soil fertility improving measures is high population pressure and scarce land; it is also widely felt that labour is a main constraint to soil conservation and improved soil management (Stocking and Abel, 1992).

Farmers in the surveyed villages get access to land in three ways: inherited from parents, purchasing and renting. It was reported that although the poor may have a title for possessing land, the title is not always secure as they may be forced to sell their land in case of unexpected requirements for cash.

Survey results show a clear difference between rich and poor in household size, land area per household and the ratios of land to people and land to labour (Table 2). Rich households have a larger household size, and more land per household and per capita. However, in contrast to their larger land holdings, the rich households have a more severe labour shortage than poor households.

Land fragmentation and distances from the home also influence soil management. Similar to observations elsewhere in Uganda, due to population pressure, land holdings have become smaller in the

last two decades. The plots of land possessed by rich households are relatively larger in size, but are more fragmented and far from home than those for middle and poor households. This increases the land management requirement for labour in rich households .

Table 2 Access to land and labour by households with different wealth status

District	Wealth status	Household size (persons)	Land area per household(ha)	Land area per unit of labour (ha)	Number of plots	Distance to home (km)
Kapchorwa	R*	7.4	1.7	0.5	4.4	2.9
	M*	6.2	0.6	0.3	2.0	1.8
	P*	4.9	0.5	0.3	1.6	1.8
Mbale	R	11.1	4.2	0.9	4.8	3.4
	M	9.7	2.3	0.8	3.5	2.9
	P	5.3	0.8	0.4	2.2	2.2

*R-rich, M-medium, P-poor.

3.1.3 Access to financial capital

Formal credit loans are not available in the study area. Farmers get access to financial capital mainly through selling animals and crop products. Cattle are the most common livestock kept by farmers. There is a higher percentage of rich farmers keeping cattle than poor farmers. However, the priority purpose of animal keeping differs between rich and poor farmers (Table 3). While most poor keep cattle mainly for the purpose of increasing their income, most rich farmers keep cattle to meet mainly their labour shortage. Neither many rich or poor mentioned the use of cattle to provide manure for soil improvement.

Table 3 Livestock (cattle) in Kapchorwa

Wealth status	Percent of households	Purposes of cattle keeping		
		Cash income	Labour	Manure
R	89.5	35.3	52.9	11.8
M	77.3	58.8	29.4	—
P	44.8	69.2	23.1	7.7

Cash income by selling crop products is influenced to a great extent by agricultural policy and market fluctuation. Fig.1 shows the influences of national policy and market fluctuation on coffee production in one of the study villages as recalled by the farmers. Farmers also recognised that the ignorance of coffee plantation management led to severe soil degradation indicated by the poor yield response to fertilizer application.

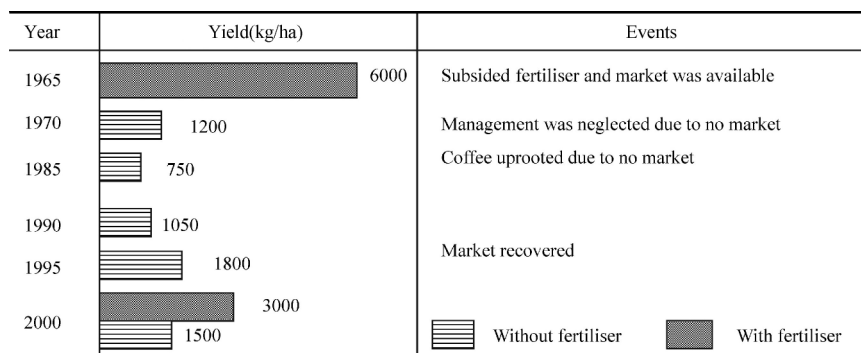


Fig. 1 Trends in coffee yield, Kabore village, Kapchorwa

3.1.4 Access to information/technology

Farmers get access to information/technology on soil management from different sources (Table 4). Extension officers, NGO/Project personnel, family members and other farmers are the main sources; however, different categories of farmers approach these sources differently. The poor farmers are more likely to get access to information and technologies from family members and fellow farmers, while the rich farmers are more likely to ask extension officers and NGO/Projects personnel. The observation indicates that the formal extension and outreach services are not targeting the different categories of farmers properly, where by the poor farmers are in most cases left out. It also indicates the importance of farmer-to-farmer extension and the need for partnership between extension officers and client farmers.

Table 4 Access to information/technology by rank

Wealth status	Sources of information/technology by rank				
	1 st	2 nd	3 rd	4 th	5 th
R	Extension officer	NGO & Project personnel	Family members	Other farmers	Radio/news papers
M	Extension officer	Family members	NGO & Project personnel	School	Other farmers
P	Family members	Other farmers	Extension officer	NGO & Project personnel	School

3.2 Perceptions on soil fertility management

3.2.1 Soil problems perceived by farmers

Table 5 lists the five most frequently reported constraints to crop production by different groups of farmers in the two districts. The other less frequently reported constraints include land fragmentation, long distance from home to field, transportation and weed infestation.

Table 5 Constrains to crop production by rank

Site	Wealth status	1 st	2 nd	3 rd	4 th	5 th
Kapchorwa	R	Unfavourable soil conditions	Pests & diseases	Lack of labour	Lack of input	Poor marketing facilities
	M	Unfavourable soil conditions	Pests & diseases	Lack of inputs	Lack of land	Lack of labour
	P	Unfavourable soil conditions	Pests & diseases	Lack of inputs	Lack of Labour	Lack of land
Mbale	R	Lack of labour	Unfavourable soil conditions	Pests & diseases	Lack of input	Theft
	M	Pests & diseases	Lack of inputs	Unfavourable soil conditions	Lack of labour	Unfavourable weather
	P	Lack of inputs	Unfavourable soil conditions	Lack of land	Pests & diseases	Unfavourable weather

Two observations can be made from Table 5. The rank of soil constraints to other crop production constraints varies with the physical environment. In Kapchorwa all surveyed villages were on steep slopes and farmers experienced rapid decline in soil fertility, mainly due to erosion, in the last decade. Worsening soil condition has been the greatest constraint to all the surveyed farmers in Kapchorwa district. In Mbale district the surveyed villages were on less steep slopes where decline in soil fertility has occurred over a long period of cultivation in which case the farmers were more concerned by the lack of

input, and by pest damage. The constraints to crop production, although similar to all groups of farmers, are ranked differently by different groups of farmers where rich farmers are more concerned with the physical constraints and shortage of labour while poor farmers are more concerned with the financial constraints relating to shortage of inputs and limited access to land.

3.2.2 Current and expected soil management measures

A number of different conservation and SFM practices are currently used by farmers in the area (Table 6). Most commonly practised are those measures requiring least labour and materials or where the materials are locally available. Fertiliser, which is thought expensive by most of the farmers, is used only by few, mainly rich farmers, on maize and coffee fields. Although farmers were aware that terraces were more effective in soil erosion control, few construct terraces in their fields and most of these derive from the colonial period. Table 7 further demonstrates that among the soil management measures which farmers are willing to adopt, almost all of them are based on vegetation and organic matter management with the benefits of improving soil fertility and preventing erosion at the same time. Indeed this is exactly what good land husbandry aims to achieve.

Table 6 Soil fertility management measures practised by farmers in the two districts

Wealth status	Percentage of households practising				
	Mulching	Manure	Contour Bunds	Fertilizer	Terraces
R	100	57.9	23.7	18.2	7.8
M	100	48.9	11.3	13.1	4.5
P	100	48.3	19.8	8.6	9.6

Table 7 Soil management measures which farmers are willing to adopt, maintain and improve

Districts	Interested activities	Percentage of households
Mbale	Soil erosion control by Napier grass strips	52.3
	Making compost manure	30.8
	Mulching for moisture conservation	10.8
	Manure management and use	9.2
	Fertiliser management	7.7
Kapchorwa	Soil erosion control by Napier grass strips	80.1
	Tree planting	78.7
	Soil erosion control by bund construction	66.3
	Fertiliser management	55.1
	Making compost manure	44.9
	Mulching	7.9
	Cover crops	6.1

4 Matching technical options with livelihoods

Soil management options can only be sustained if they contribute to the sustainability of local livelihoods. To link soil management and livelihood it is essential to understand the diversity and dynamics of livelihoods and flexibility, effectiveness and resource demands of soil management options. Since local livelihoods are diverse, there are different combinations of assets and various strategies to pursue livelihood outcomes. For example rich farmers are better off in getting access to land and financial capital (more cattle and coffee), but they may suffer increasing labour shortage. Resources demanded of a soil management measure, as shown in Tables 6 and 7, are an important criterion used by farmers in distinguishing good from poor soil management measures. Simple and less resource demanding measures with fertility improvement are much favoured. Unfavourable soil condition is only one of the constraints faced by farmers, and its impacts on livelihoods vary with area and household (Table 5). It is therefore

important to integrate the soil management options into the overall livelihoods strategy. From perception of soil problem to the actions to be taken, there is a process of decision-making taken within the broad context of livelihoods. Based on the above analysis, Fig.2 summarises the key steps to link soil management with local livelihoods and the key points where essential knowledge and practical tools are needed.

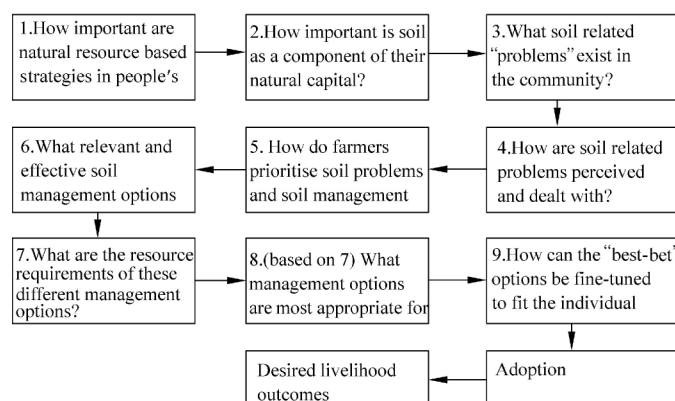


Fig.2 The framework to link soil management with local livelihoods

5 Conclusion

Good soil management is one of the strategies by which farmers gain their livelihood outcomes. The diversity and dynamics of local livelihoods, as demonstrated in this paper, requires technical options in soil management be effective in contributing to livelihood outcomes, and be flexible to fit different situations. LPs are, therefore, facing crucial challenges: (a) understanding the complexity of local livelihoods in relation to soil management; (b) prioritising soil management in the broad context of livelihoods; (c) providing technical options, including research-derived and indigenous practices of soil management and guidelines for fine-tuning the technical options into specific situations; and (d) establishing the partnership between client farmers and researchers. Practical tools and approaches are needed to enable the LPs to tackle the challenges. This paper, based on the initial findings of an ongoing project, presents a framework and the essential information to link soil management to local livelihood. The framework could be used as a guideline for the development of the tools and approaches.

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