Uganda Journal of Agricultural Sciences, 2003, 8 : 313 - 322 ISSN 1026-0919
Printed in Uganda

Constraints to the adoption of soil conservation and fertility management techniques in the mt. Elgon areas, Uganda

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Abstract

Soil fertility management and soil conservation are viewed as major components of sustaining crop production in the steep slope farming areas. A survey was conducted in eight villages of mountain Elgon areas of Mbale and Kapchorwa district (four from each district). In four of the villages (2 from each district) a detailed household (HH) survey on soil management was conducted. The HHs were divided into three wealth categories (rich, middle and poor) following criteria developed by the farmers themselves. From these categories, 10, 10 and 15 HHs were selected from the rich, middle and poor, respectively, for the survey. In the other four villages focus group discussions were conducted. The results revealed that although Kapchorwa district had smaller HH sizes, it had a higher land pressure than Mbale (0.4 compared to 1 acres of land per HH, respectively), and still had more labour problems. Livestock keeping in Kapchorwa was significantly higher ($P<0.05$) than in Mbale. Soil fertility was reported to be low in both districts but soil erosion and lack of inputs were significantly more prominent ($P<0.05$) in Kapchorwa than Mbale. For soil conservation measures, mulching is practiced by the majority of farmers, followed by manure application, terracing and soil bunds. Fertilizer application was only reported in Kapchorwa district. Major sources of information are extension officers and other farmers for Kapchorwa; relatives, NGOs and other farmers for Mbale. The type of information from these sources to most farmers is to do with crop management and general agricultural methods but in most cases this is not adequate. From the survey information gathered it was evident that lack of knowledge, labour and distance of farmers' fields from the homestead are the major constraints to soil conservation and fertility management. Wealth status may have a role to play, especially in the adoption of soil management techniques that require financial inputs; however, this may not be as significant since some poor farmers with small fields were reported to have had good soil conservation and fertility management measures.

Key words: Conservation, Soil fertility management, Adoption, Wealth categories

Introduction

Soil conservation measures minimize erosion, control runoff, improve soil fertility, retain rainwater where it is needed and sustainably enhance land productivity. Soil fertility management (SFM) practices maintain soil's ability to supply crops with nutrients in available and sufficient quantities. Although a lot of research has been generated for both soil conservation and SFM, very little research has been done on the combination of both these two important aspects of soil management (Tumuhairwe et al., 1998; Tukahirwa and Veit, 1991). A lot of soil conservation techniques have been designed and utilised successfully in the various mountainous areas of Uganda especially Kabale (Bagoora, 1988). However, SFM packages have been especially designed for the low plains especially within the lake Victoria basin (Bekunda, 1992; Wortmann and Kaizzi, 1998; Bekunda, 1999; Nkalubo *et al.*, 1999). In addition, much of the research to improve soil productivity in Uganda is donor driven. Consequently, farmers have not adopted research findings partly because they are not involved in the planning of such research but only at the implementation stages. Thus they do not take the research as their own but rather as something from which they can benefit monetary-wise for as long as that project lasts.

The decline in soil productivity within the hilly areas of Uganda emanates from the fact that most productive soils are eroded due to the crude methods of cultivation being employed. Farmers have continued misusing their land not for the sake of it but due to lack of better alternativesand the need to produce something to eat. In addition, the absence of either a soils policy or a land use policy in Uganda has left the farmers to always respond to soil erosion in a variety of ways, all of which may not be geared towards conservation. The colonial government initiated a programme of ensuring the control of soil erosion through a series of by-laws and activities as perceived by requirements of various areas. In Lango (Lira and Apac districts) contours and land consolidation were emphasized. In Kigezi (Kabale and Rukungiri districts), emphasis was put on grass strips and soil bunds. Grass strips or bushes were planted parallel to the contours at specified vertical intervals, so that soil being eroded down between two successive soil bunds would be trapped by the bund. The accumulation of soil in the area between two successive bunds kept leveling them out, reducing the gradient between successive strips, and eventually forming a bench. This process led to the formation of the terraces in Kabale (Bagoora, 1998). It is only in Sebei (Kapchorwa district) where terraces were actually constructed using machinery from the Department of Agriculture. In Buganda, graded channels were constructed and the lower parts were planted with grass, mainly pasparum. Graded channels controlled and conserved water from the upper slopes. Mulching was emphasized everywhere as both an aspect of good husbandry and for control of soil erosion. Overgrazing and bush burning were strongly discouraged as they expose the soil and make it vulnerable to erosion. The above policy measures were backed by relevant legislation and were mandatory and enforced by law (Dramadri, 1996).

Mountain Elgon is shared by both Uganda and Kenya. On the Ugandan side, Mt. Elgon covers the districts of Kapchorwa, Mbale and Sironko. Soil fertility decline and increasing land degradation are major problems in these densely populated Ugandan hillsides. Thus there is a direct relationship between food security and rural livelihood development and the problems of soil conservation and fertility management. Research generated to counteract these land degradation effects has not shown as much impact in this area as in other areas where they have been tried. The thrust of this study, therefore, was to identify constraints that dissuade farmers of the Mountain Elgon areas of Uganda from adopting the already established soil conservation and fertility management methods/techniques.

Materials and methods

Site description and selection

The survey was conducted in the districts of Mbale and Kapchorwa during December 2000. The survey team included 2 soil scientists, 2 social scientists, 1 natural resources expert and district extension workers attached to the sub counties where the survey was conducted. Eight villages, four from each district, were chosen to represent the different altitudes, cropping systems, land-use intensity and type/degree of soil related problems. Four of the villages were chosen for detailed household surveys and these included: Namaistu and Buwopuwa in Mbale and Kabore and Bisho in Kapchorwa, while focus group discussions were held in Bunembe, Bukhasusa, in Mbale and Kewachesite and Kongta in Kapchorwa.

Wealth ranking

In order to capture the full range of wealth status in the villages, a stratified sampling method was used. Before sampling, a wealth ranking exercise was conducted to divide all the households in the village into three wealth groups: rich, middle and poor. In each group, households were selected randomly: 10 rich, 10 middle and 15 poor households.

The framework of questionnaire

The survey was conducted using a questionnaire, which was composed of four sets of questions structured around the access to assets; awareness of soil problems in the broad context of crop production; responses to the perceived problems; and existing tools and approaches which help farmers address the problems, and the aspects perceived by farmers for further improvement.

Data analysis

The data were compiled and summarised using the Statistical Package for Social Scientist (SPSS) and statistically analysed using two way analysis of variance (ANOVA), with the Genstat programme.

RESULTS

Wealth status, land distribution and availability of labour

Table 1 shows that the HH sizes were not significantly different within the respective districts but on the whole, HHs within Mbale district were slightly bigger than those in Kapchorwa. Although there were no significant differences between the HH sizes of the different wealth categories in Kapchorwa, the rich HH sizes were larger in Mbale ($P<0.05$) than the poor HH sizes.

However, HH sizes for the rich were not significantly different from the middle HHs. Considering all the wealth status categories, average land size per HH was higher ($P<0.05$) in Mbale than Kapchorwa. Although in both districts the rich HH had almost twice the land available to the middle HH and more than double that available for the poor farmers, the land per capita and land per labour force situation was similar.

Distribution of livestock

The types and numbers of livestock kept by farmers depended on the wealth status of the HH (Table 2). The percentage of HHs keeping cattle in both villages was significantly lower ($P<0.05$) in the poor HHs than the middle and rich. In the latter two wealth categories, the percentages of HHs keeping cattle were not significantly different ($P<0.05$). Percentages of goats, pigs and chicken kept by the different wealth categories were also not significantly different ($P<0.05$). On average HHs in Kapchorwa had higher ($P<0.05$) numbers of cattle and goats than in Mbale. On the other hand, HHs in Mbale have significantly higher pigs and chicken than the farmers in Kapchorwa. Rich HHs possess higher ($P<0.05$) number of livestock per HH than the middle or poor HHs. Pigs were an exception; they were mainly kept in Mbale district and mainly by the middle and poor HHs.

Table 1. Wealth status, access to land and labour by different household wealth categories.

Sites	Wealth status	HH size	Land area/ HH (acre)	Land area/ capita	Acre of land/ labour
Kapchorwa	Average	6.2	2.4	0.4	0.9
	R	7.4	4.3	0.6	1.3
	M	6.2	1.5	0.3	0.7
	P	4.9	1.3	0.4	0.8
Mbale	Average	8.7	4.9	1.0	1.8
	R	11.1	7.0	1.6	2.3
	M	9.7	5.7	0.8	2.0
	P	5.3	2.0	0.5	1.0
%CV		17.6	46.1	24.2	29.8
Lsd (0.05)		4.6	0.5	ns	ns

R = rich M = middle; P = poor

Table 2. Livestock keeping by the different wealth categories of households.

Sites	Wealth status	% of HH possess				Average No per HH			
		Cattle	Goat	Pig	Chicken	Cattle	Goat	Pig	Chicken
Kapchorwa	Average	67.1	58.6	4.3	82.9	2.6	2.2	0.1	5.5
	R	89.5	63.2	5.3	84.2	5.5	4.0	0.1	9.5
	M	77.3	50.0	9.1	100	1.8	2.0	0.1	5.0
	P	44.8	62.1	0	69.0	1.3	1.3	0	3.2
Mbale	Average	63.9	54.2	36.1	93.1	1.6	1.6	0.9	11.4
	R	78.9	68.4	21.1	100	3.0	2.9	0.7	15.9
	M	69.6	65.2	43.5	91.3	1.6	1.7	1.1	13.3
	P	50.0	36.7	40.0	90.0	0.8	0.8	0.9	7.0
CV (%)		8.7	26	45.2	12.6	37.9	13.9	30.5	17.8
Lsd (0.05		25.60	ns	ns	ns	0.88	0.29	0.15	1.60

Soil management problems experienced

The major problems to soil management were lack of inputs, soil erosion and low soil fertility (Figure 1). Soil erosion and low soil fertility were experienced by significantly higher ($P<0.05$) number of farmers in Kapchorwa than Mbale while the lack of inputs was more serious with the HHs in Mbale district. Lack of labour and land in both districts had almost the same magnitude and was only reported by a few HHs.

Soil conservation and SFM practices available

Table 3 shows that whereas terraces, soil bunds and mulch as soil conservation and fertility measures were utilised almost equally by all wealth categories of HHs in the two districts, use of inorganic and organic fertilizers (manure) was higher ($P<0.05$) in Kapchorwa than Mbale. In fact the use of inorganic fertilizers was very low in Mbale district. Within Kapchorwa, use of these two soil inputs was almost similar between the rich and middle HHs.

Figure 1. Problems to soil management faced by different households

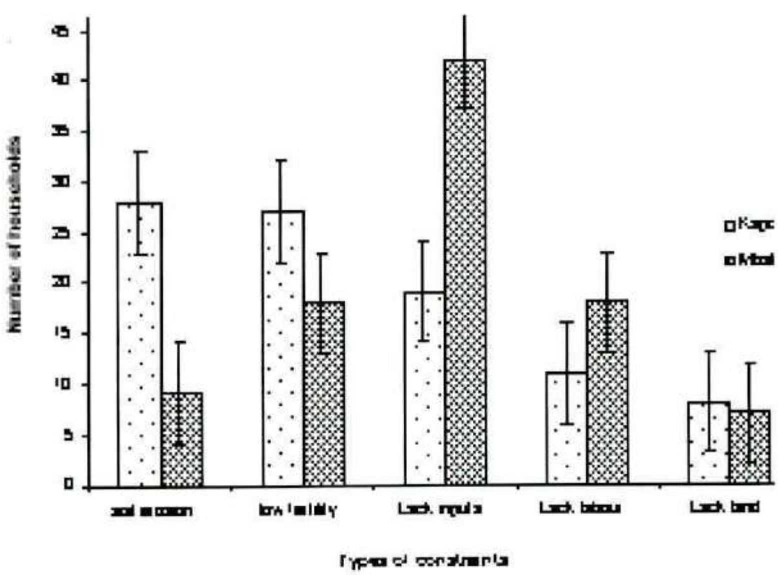
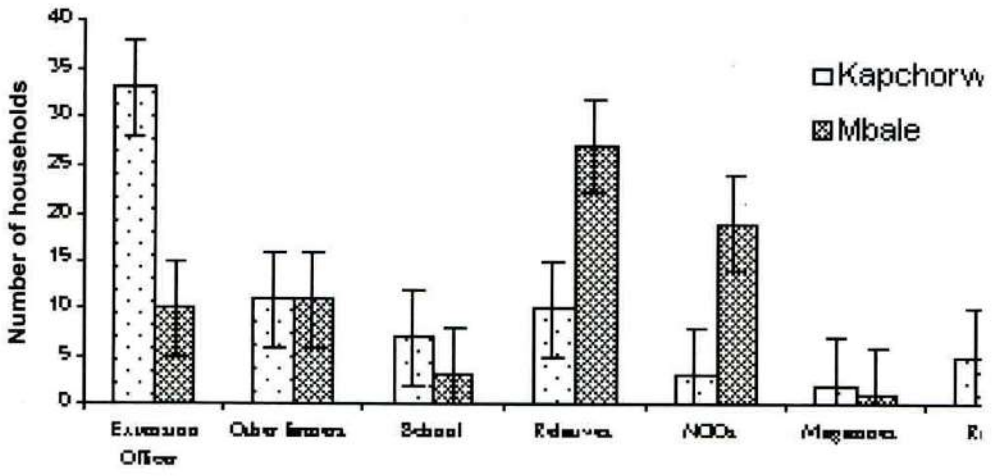


Table 3. Percentages of HHs using different soil conservation and fertility measures.

District	Wealth status	Inorganic fertilizer	Terraces	Manure	Soil bunds	Mulch
Kapchorwa	R	26.3	10.5	57.9	15.8	100
	M	36.4	4.5	50.0	18.2	100
	P	17.2	17.2	48.3	31.0	100
Mbale	R	0	5.2	57.9	31.6	100
	M	0	4.3	47.8	4.3	100
	P	0	9.6	48.4	9.7	100
CV (%)		51	31.3	1.8	75.3	ns
Lsd (0.05)		23.7	ns	3.95	ns	ns

Figure 2. Farmers' accessibility to the sources of information available.



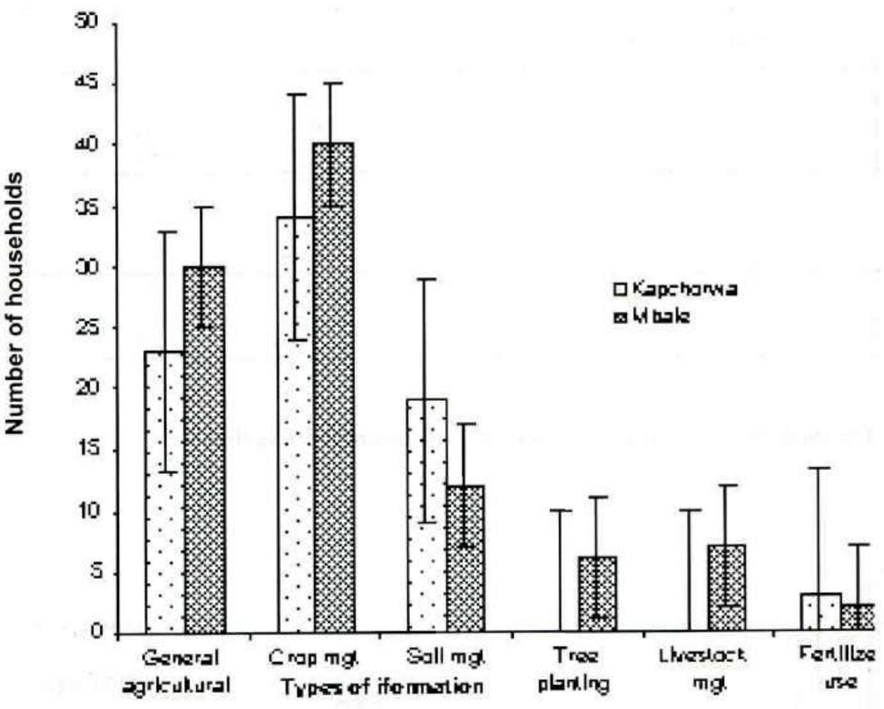
Sources of agricultural information

Figure 2 indicates that the farmers' major sources of information differ depending on the district. Whereas farmers in Kapchorwa acquire more information from extension agents, those in Mbale derive most of the information from relatives and NGOs. These three information sources are utilised by significantly more ($P<0.05$) farmers in the respective districts than the other sources. These other sources of information are utilised by very few individuals and there was no significant difference in their extent of utilisation between the two districts.

Types of agricultural information available to farmers in the different districts

The type of agricultural information normally availed to farmers in both districts is crop management followed by general agricultural information (Figure 3).
Information regarding soil management, tree planting, livestock management and fertilizer use is only available to a few farmers. All these types of information are available in significantly the same ($P<0.05$) proportions within farmers of the two districts.

Figure 3. Types of agricultural information available to farmers



Discussion

Farmers' wealth categories

The classification of farmers into the different wealth categories was done using criteria given by farmers. The criteria identified included size of land possessed, heads of cattle per HH, education status of HH head, nature/quality of house possessed, etc. It was comprehensive and multidimensional, and included both quantitative and qualitative indicators (data not shown). Not only do the rich farmers have more natural and physical assets, they also have better education and more access to information and new techniques than the middle or poor ones. Their livelihoods are therefore more diversified with many conducting business outside farming and producing crops for commercial purposes. From the information gathered, it was clear that the poor category HH had low accessibility to new/appropriate information and techniques. This category of farmers is also the least informed in terms of new information, as extension workers do not prefer to work with them because of their limited possessions, especially land. The reason here is that, for example if the extension worker conducted an experiment/demonstration on the poor farmer's land and it failed, it is most likely that the farmer will starve, which may not be the case with a rich farmer with plenty of land.

Access to land and labour

According to Busingye (1998) one of the preconditions for adopting soil conservation and soil fertility improving measures is that population pressure should be high and land scarce. It is also widely felt that labour is a main constraint to soil conservation and improved soil management (Busingye, 1998). Our survey showed that in the villages surveyed there is a higher land pressure and more severe labour constraints (in terms of labour per unit land area) in Kapchorwa than in Mbale. In both districts, there is a clear difference between rich and poor in HH size, land area per HH and the ratios of land-people and land-labour (Table 1). It is also clear that in both districts, rich

HHs have more people, more land per capita but a more severe labour shortage than poor HHs and this is attributed to the large acreages of land they own. This is shown by the lack of significant differences in the land area per unit labour of the different wealth categories. Because of this lack of labour, the rich HHs have been known to rent out their land to either the poor or middle wealth category HHs at a fee (data not shown). This has led to the mismanagement of such land since the farmers who rent the land are only interested in the yield rather than soil conservation and management. Thus size of land and the amount of labour available might influence the type of soil management measures a HH is able to undertake. Also because of the terrain of land (steep slopes), most of the homesteads are found in the lower slopes and farms are located in distant places along the steep slopes. This setting has favoured fields near the homesteads whenever soil conservation and fertility management measures are sought after. Thus, those fields that are distant from the homestead rarely receive conservation measures, due to the long distances involved to carry out the intervention protocols.

Livestock keeping and the purposes

Different HHs keep animals mainly for the purposes of cash income and home consumption; only a small portion of people gave manure production as one of the main reasons (Table 2). Another main purpose for cattle keeping is draft power and 23.7% of cattle keepers reported this as the main reason for keeping cattle. Interestingly, in the villages in Kapchorwa, richer farmers (53% of cattle keepers) were keeping cattle mainly for labour, in contrast, only 23% of poor cattle keepers kept them primarily for labour. Regarding pigs and chicken, 3.4% and 0.8% of pig and chicken keepers, respectively, believe manure to be one of the main products. In most cases the manure from livestock is not used intentionally but rather dumped in the field as a way of getting rid of smelly stuff during the cleaning of the livestock houses especially the birds. The wealth category of the HHs is a significant player in determining the number of animals (especially cattle) a HH possess. The ability to utilise livestock waste, however small, in soil fertility maintenance, depends on the know-how of the different HH, otherwise, most HH utilise waste (especially cattle dung) as a building material.

Soil management problems

The two districts possess similar soil constraints although at varying degrees. Whereas soil erosion is perceived as the biggest problem in Kapchorwa (because of the steeper slopes), HHs in Mbale view the lack of soil inputs like fertilizers and manure as the major problem. The lack of soil inputs in Mbale may probably arise from the fact that although the farmers may have little knowledge on the use of fertilizer, they are expensive and not very readily available. On the other hand Mbale HHs have fewer cattle as compared to Kapchorwa (1.6 to 2.6 per HH; Table 1). Since Kapchorwa is nearer to Kenya where the use of fertilizer on maize growing is very popular, farmers have adopted the practice very easily. Low soil fertility and lack of inputs are common constraints in the two districts. In fact these two constraints are closely linked whereby low soil fertility leads to poor performance of crops and lack of inputs leads to continuous depletion of soil nutrients leading to low fertility and thus poor crop yield. Although land and labour shortages are constraints to soil conservation and fertility management, farmers do not envisage these two as very big problems. Table 1 clearly shows that labour is a serious problem as far as both districts are concerned, the average being between less than 1-2 people per acre of land. The information collected from the survey further indicates that in this Mt. Elgon hillsides area, improving soil fertility and controlling soil erosion are the main entry points for removing the physical constraints to crop production. Any interventions to be taken must have a low input demand, as farmers' capacity to supply, or afford extra inputs is limited especially for the poor HHs, yet these constitute the majority of farmers in the two districts (Table 1).

Use of soil conservation and SFM practices

A number of different conservation and SFM practices are currently practised in the area including application of chemical fertilizers, mulch, terraces, bunds and grass strips (Table 3). The most widely used measure is mulching in banana fields, which all farmers are practising due the fact that at least each HH possess a banana field where most of the dry psuedostems and leaves are returned. The use of manure is also widely used and this is attributed to most of the HHs being in possession of livestock. The survey revealed that use of chemical fertilizer was more in Kapchorwa district and mainly on the maize fields. This is probably due to their proximity to Kenya where fertilizer use technologies is at an advanced stage. Rich and middle income HHs use fertilizers on a higher percentage of their fields than poor HHs. Construction measures like terraces and bunds are less practised in both districts regardless of the wealth status. This is due to the high labour demand required for the implementation of such technologies and yet individual HHs are reported to have labour constraints (Table 1). All in all, the most commonly cited constraints to soil management were the lack of knowledge and labour.

Distance from homestead determines in part the amount of attention given to a particular field. Fields near the homestead are normally better conserved than those in distant areas. In connection with distance is the labour force a farmer possesses. Rich farmers may afford to hire labour but the poor ones will always depend on the family labour. If such labour is not available or low then the farmer may never implement such soil conservation measures like terraces and bunds, which may be required on steeper slopes where soil erosion is very evident and more destructive. Similarly, if there is need to carry soil inputs like manure to distant fields, this may be difficult to carry out.

The number and types of livestock kept by farmers do not directly relate to the soil fertility management measures he will undertake. In many cases farmers utilise the waste products in the construction of houses. This may imply that such a farmer lacks knowledge required in the utilization of such materials. In this case the constraint is knowledge rather than the number and type of livestock available per farmer. It is also possible that farmers consider use of waste for construction of houses more of a priority to them. This may arise from limited knowledge on the potential value of such materials in SFM. The lack of knowledge is also related to limited sources of information available to farmers. In cases where the extension workers are absent or less knowledgeable, farmers normally depend on each other as sources and final users of information, most of which may not be relevant. Of significant importance is the type of information relayed to the farmers. Most of this information deals with crop management issues and very little is availed concerning soil conservation and soil fertility management, probably because most extension workers have not been trained in this field.

Sources of information

Although the most popular source of information was extension officers (Figure 2), farmers are not satisfied with the current agricultural service. In fact the use of extension staff, which is higher in Kapchorwa than Mbale, could further explain the high use of soil inputs like fertilizers and manures in Kapchorwa than in Mbale. Relatives and NGOs are the main source of information to farmers in Mbale. The NGOs, which are more dominant in Mbale than Kapchorwa, have generated some awareness in agricultural production, but unfortunately very few NGOs are dealing with soil conservation and SFM. Magazines, radios and schools were not very popular since a good percentage of the farmers were semi-literate. Farmers feel they need further knowledge on soil and crop management, particularly knowledge on application of fertilizers, compost and manure use, use of agricultural chemicals, and livestock management, which are currently relatively unavailable from existing sources. There was a general complaint that extension officers are often not present or unavailable to farmers, and if present they at times lack the information most relevant to farmers but all in all, extension is still listed as the most important source of information. Improving the extension service thus seems particularly relevant. The importance of other farmers as a source of information suggests that it could be efficient for extension officers to work with demonstration farmers to disseminate information. On-farm experimentation with farmers, farmer-to-farmer visits and farmer field schools could all be effective approaches in promoting better soil and crop management practices.

Types of agricultural information

Crop management and general agriculture are the most common types of information the farmers are availed with. This is explained by the different sources where the information is derived. Most extension agents, relatives and NGOs normally deal with crop management including a few tips on crop agronomy which are normally passed on from one farmer to another. Soil management is on the increase probably because of the effects related to erosion; a lot of emphasis has been put in protecting the soil from run off. Knowledge of soil fertility management is still very low as depicted by the scanty information available on fertilizer use (Figure 3).

Conclusions

The findings of this survey have highlighted that even in poor villages, there are obvious differences between rich and poor households in terms of assets and livelihood strategies. Although soil erosion and decline in soil fertility are recognised as major constraints, among others, to crop production, most of the soil conservation and SFM practices are not widely adopted, regardless of the wealth status of households, except for application of chemical fertilizer which is more commonly practised by rich households on high value crops. This indicates that farmers are more interested in measures that provide quick returns or need fewer inputs such as mulching in banana fields using banana leaves. Farmers have not wholly adopted the different soil conservation and SFM measures available. Results of this survey show that wealth, although a player in management of soil fertility where inputs like fertilizers are required, may not always be a major constraint to soil management since some poor farmers have been shown to manage and conserve their small fields better than the rich farmers. This is especially the case where the latter may derive more of his livelihood from off-farm activities other than farming. This also disqualifies land size as a constraint to soil management.

Security/ownership over land being cultivated is a prerequisite to sound soil management. Rented land is often mismanaged since the farmers who rent the land are only interested in the yield rather than soil conservation and management. Land size and the amount of labour available influences the type of soil management measures a household is able to undertake.

The identification of constraints to the adoption of soil conservation and soil fertility management can only help to review the approach in the methods in which the techniques of the same are developed and passed on to the final users (farmers) in their respective wealth categories. The fact that extension service is viewed highly by farmers as the likely source of information on farming activities, including soil management, justifies the need to equip and strengthen this medium of communication to farmers to act as a source of knowledge.

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