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Difficulties in assessing outcomes of soil and water conservation extension messages in banana based cropping systems: a case study of student projects at Makerere University, Uganda

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Abstract

Observations made on students following a BSc degree program for mid-career extension professionals at Makerere University show a tendency to promote soil and water conservation as a matter of course without regard to realistic opportunities for successful application by farmers. In addition, recommendations on soil and water conservation techniques in banana based cropping systems seem unclear making it difficult to assess effectiveness of extension and application by farmers. This study was designed to identify potential for extension impact in soil and water conservation and to identify objective ways of teaching and assessing farmers' application of the different techniques. The study was done through a case study of three student projects involving 135 farmers. Key recommendations for each technology were identified and objective ways of assessing farmer application were agreed with the students. A questionnaire for assessing application and associated problems was designed which the three students used in evaluating their projects. Critical issues arising from the assessment were presented to a seminar of soil scientists and extension experts for discussion. The study revealed the need for addressing the scarcity of mulching and compost materials and labour if the most commonly recommended techniques, mulching, compost manure and contour bunds, are to be more widely applied. The study also revealed difficulties in using specifications for soil and water techniques as an objective way of assessing effectiveness and outcomes of extension, firstly because of lack of clarity of the specifications and, secondly because of the multipurpose nature of the soil and water conservation techniques. The specifications are designed to control soil erosion whilst the farmers' main concern in applying them is water/moisture conservation and soil fertility improvement as soil erosion does not seem to be a big problem in banana based cropping systems.

Key words: Application, conservation technique, soil fertility

Introduction

Following a request from the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), Makerere University launched a responsive B.Sc. programme specifically designed to improve performance of mid-career agricultural extension professionals. The programme, which was launched in 1998, seeks to buttress the practical experience of agricultural extension agents to enable them deal with the challenges of agricultural development in Uganda. The programme is unique in its practical orientation (Mutimba *et al*., 2003). Experiential learning is at the foundation of the programme. As part of their training, the students together with their employers, farmers and researchers, develop supervised extension projects (SEPs) proposals relevant to their job as extensionists that they go back and implement in their work places for periods ranging from six to eight months.

SEPs differ substantially from the regular students' research projects in that they (SEPs) are 'action research' in nature - action to improve farmers' welfare and research to increase se knowledge (Mutimba 2003). Each project, therefore, has two objectives – a production objective and a learning objective. The production objective is stated in the form of benefits to farmers. This could be in the form of improved yields, improved quality of produce or reduced losses. The learning objective is what the student wants to learn in the process to improve his/her competencies or understanding as an extensionist. The learning objective should be in support of the production objective. It could be in the form of a mini-action research as a way of accomplishing the production objectives. For example, a student could start with a survey to find out why a particular technology does not seem to have been widely adopted before s/he decides on a strategy to promote it. A learning objective could be in

the form of trying to understand the effectiveness of an extension or training method or an extension approach. The learning objective is actually the research part of the project for which the student has to systematically collect, analyze and present data.The students are expected to achieve meaningful impact through these projects as they join the programme with a diploma in agriculture (or related fields) and several years of field experience.

Since the start of the BSc programme in 1998, one of the common topics for student SEPs has been 'soil and water conservation' as one of the solutions for addressing the problem of declining low banana yields that is usually raised by farmers during needs assessment. However, observations emerging from these projects have been that students tend to promote soil and water conservation as a matter of course without regard to realistic opportunities for successful application by farmers. In addition, recommendations on soil and water conservation techniques in banana based cropping systems tend to be unclear making it difficult to assess effectiveness of extension and application by farmers. This prompted the researchers to set up a study to identify potential for extension impact in soil and water conservation and to identify objective ways of teaching and assessing farmers' application of the different techniques.

The main objectives of the study were: to identify soil and water conservation techniques most commonly applied by farmers, to identify major problems inhibiting the successful implementation of soil and water conservation techniques, to identify unexploited opportunities for further extension impact in soil and water conservation, to identify objective criteria for assessing outcomes of extension efforts in soil and water conservation, and, to identify objective criteria for assessing adequacy of farmer application of soil and water conservation techniques.

Methodology

The study was done through a case study of three student projects involving 135 farmers. Between July and September 2003, students trained farmers on soil and water conservations techniques. They taught them the advantages and precise specifications for each technique. They then went back in March 2004 to assess the effectiveness of their training. It was agreed that this would best be done by assessing adequacy of farmer application of soil and water conservation techniques taught, for which measurable criteria were needed. It was agreed that assessing farmers' knowledge and use of the precise specifications for each technique would be an objective way of assessing effectiveness of training, hence, outcomes of extension. Two of the most commonly recommended techniques, contour bunds and mulching, were selected for analysis. Key recommendations for each technique were identified and a questionnaire to assess knowledge, application and associated problems was developed. Assessment of farmers' knowledge was done through individual interviews, or oral tests, while assessment of application was done through observation and taking measurements of actual specifications and comparing with the recommended. Reasons for any variances were discussed with the farmers. Data was analyzed through simple descriptive statistics. Critical issues arising from the assessment were presented to a seminar of soil scientists and extension experts for discussion.

Results

Soil and water conservation techniques most commonly used by banana growers. Table 1 below shows the most commonly used soil and water conservation techniques. Banana growers were found to grow a range of crop and tree species in the same plot with bananas. It was therefore difficult to tell the difference between intercropping and agro forestry as farmers practice both on the same plot in various combinations. For example, one farmer had 20 different species of crops and trees in his 0.5 ha banana plot. Ninety one percent of the sample farmers had a mixture of both intercropping and agro forestry in their banana plantations. Farmers do this without much advice from extension apart from general encouragement. There are no specific recommendations on how it should be done. In addition, the practice is not officially recognized as either intercropping or agro forestry because, as one scientist put it, 'crops and trees are just scattered without any particular pattern'.

Students mostly focus on contour bunds and mulching for which specific recommendations exist. The construction of contour bunds usually goes with grass strips (e.g. elephant grass) planted on the bunds partly to stabilize the bunds and also to provide livestock feed. Cover crops are usually in the form of short season crops like beans which farmers grow on any open spaces inside banana plantations or on newly opened banana plots. All banana growers use trash on the farm to maintain or improve soil fertility. Very few make compost manure as recommended because of the high labour demands and general lack of compost material. Only four farmers were found to use trash lines.

Table 1. Soil and water conservation most commonly used by banana growers (n=135)

Technique	Number of farmers using
Intercropping and agroforestry	123 (91%)
Contour bunds	88 (65%)
Mulching	87 (64%)
Cover crops	78 (58%)
Grass strips	60 (44%)
Compost manure	13 (1%)
Trash lines	4 (0.03%)

Table 2. Farmers' knowledge and application of contour bunds and mulching (n=135)

	Bunds	Mulching
Farmers using technique	88 (65%)	87 (64%)
Reasons for using technique		
To conserve moisture	84 (62%)	73 (54%)
To control weeds		67 (50%)
To improve soil fertility		61 (45%)
To control soil erosion	28 (21%)	57 (42%)
Number of farmers who knew the specifications for the technique	50 (37%)	70 (52%)
Number of farmers who applied technique to the whole banana fields	23 (17%)	33 (24%)
Proportion of land on which technique was applied according to specifications (for those who applied)	(43%)	(38%)
Reasons for partial or non-application		
Lack of labour	75 (55%)	54 (40%)
Flat land (therefore no need for bunds)	15 (11%)	
Lack of mulching materials		33 (24%

Problems inhibiting successful implementation of soil and water conservation techniques

Table 2 shows that although most farmers apply contour bunds and mulching, they only do so partially because of lack of labour and lack of mulching materials. The table also shows that the farmers' main reason for applying the two soil and water conservation techniques is moisture conservation as well as weed control and soil fertility improvement in the case of mulching. Sixty five percent of the farmers surveyed had constructed bunds on their banana plots but only 17% had fully applied the technique while the rest applied only to portions of the plots. Furthermore, some of the bunds were not constructed according to specifications (i.e., dimensions and distance between bunds). On average, of the plots that had contour bunds, only 43% had bunds constructed according to specifications. The number of farmers with adequate knowledge on contour bund specifications was surprisingly low (37%) considering that the survey was conducted after farmers had received training.

The main reason for not following recommendations fully, or not constructing bunds at all, was lack of labour. Contour bund construction is laborious. A few of the farmers that had bunds used hired labour while others had them constructed through work groups. The number of farmers that applied mulch was about the same as those that constructed contour bunds (64%) but the number of farmers that applied mulch to the whole banana plots was slightly higher (24%). As with contour bunds, application of mulch was uneven even within the same plots, with some portions of the plots mulched according to specifications (thickness of mulch and distance from banana stools) and other portions mulched differently. The portions of the plots mulched according to specifications were a little smaller than for contour bunds (38% on average) although the number of farmers who knew the correct specifications was higher (52%).

The main reasons for not applying mulch or for not mulching according to specifications were lack of mulching material and lack of labour. Mulching materials generated from the farm (banana leaves/pseudo stems, trash and crop residues) are not enough to cover the banana plots. Farmers living near marshes use swamp grass. They use own family or hired labour to cut and carry grass from these wet areas. The success of this technique therefore depends on the amount of swamp grass available, distance from the farm, availability of family labour and availability of cash to hire extra labour if family labour is not enough.

Each of the three students used different recommendations for the dimensions of contour bunds and, indeed, the researchers also observed that literature has several different recommendations. It was possible, therefore, that farmers would have been taught different specifications by other extension agents. Some of the specifications in literature for both mulching and contour bunds are very precise and yet vary widely while specifications for other techniques, like intercropping and agro forestry, do not seem to be available. This prompted the researchers to convene a

seminar of soil and water conservation and extension experts, including extension students, to discuss the desirability of these specifications.

The seminar came up with two disciplinary positions. The soil scientists believed that the specifications were based on research results and, therefore, they should be adhered to. The extensionists felt that the specifications should not be given as 'top down' prescriptions, but rather as frameworks within which farmers should be free to adapt.

Potential for extension impact in soil and water conservations

Seminar participants were asked to rate 28 soil and water conservation techniques according to a weighted rating scale of high (3), medium (2), low (1) and none (0). In order of ranking, the top six were multiple cropping (intercropping, mixed cropping), mulching, contour bunds, compost manure, cover crops and agro forestry. Although the result was consistent with current farmer levels of utilization (Table 1), it was surprising as recommendations for multiple cropping and agro forestry in bananas were not clear. It was not clear, therefore, what the role of extension would be in promoting these techniques. It was also not clear how extension could expand and make a visible impact on the utilization of mulching and compost manure given the limited availability of both mulching and compost materials.

Objective criteria for assessing outcomes of extension efforts in soil and water conservation

Given the wide range of specifications for each of the two techniques assessed, contour bunds and mulching, the cut-off point for determining correctness of knowledge and application was difficult to establish. The results and outcomes of this approach were, therefore, debatable and not conclusive when presented to the seminar. It appeared, according to some suggestions in the seminar, that a visual assessment of whether the techniques were controlling water runoff and conserving moisture would have been a more reliable way of assessing effectiveness of training. Some of the criteria suggested for assessing the effectiveness of the techniques were absence of signs of soil erosion (e.g. reels), even distribution of runoff water along the contour channel (e.g. no patchy pools of water), moisture conservation and appearance of the crop – but they all tended to be subjective.

Discussion

Although farmers raise the problem of declining banana yields during needs assessment and, indeed, researchers have found notable decline in soil quality (Tenywa et al., 1999), soil erosion does not seem to be a big problem in Uganda as it is in other countries. Okubal and Makumbi (2000) point out that soil erosion is a problem in only a few areas and, according to Farley (cited in Boeson et al 2003), available research shows a low degree of erodibility of soils and erosibility of rains. It would appear therefore, as Boeson et al (2003) argue, that when farmers mention land degradation as a reason for declining production, they are probably talking about soil fertility decline due to continuous cropping rather than soil erosion per se. (One farmer the research team visited in this study said that his banana plantation was over 100 years old). According to Purseglove (cited in Karugaba and Kimaru 1999), a crop harvest of 25 tonnes per hectare per year of fresh fruit removes 28 kg of nitrogen, 7 kg of phosphorous and 78 kg of potassium from the soil. Survey results in this study also seem to suggest that farmers apply soil and water conservation measures more for conserving moisture, fertility and controlling weeds than for controlling soil erosion per se (see Table 2 above).

In light of this, the concern in banana based cropping systems should be more about water and soil fertility conservation than soil erosion control. This redefinition of the problem is important and will have implications on methods and specifications to address it. Assessment of extension outcomes would therefore be done on the basis of water/moisture conservation and soil fertility improvement rather than on soil erosion control, which does not seem to be a problem. In this case, some of the precise specifications would not be necessary. While it is true that the problems of soil erosion, moisture and soil fertility are interrelated, it is important that the problem being addressed at a particular point in time be clearly defined in order to come up with the most appropriate solutions for it.

The potential successes and sustainability of some of the commonly promoted soil and water conservation techniques seem to be limited. For example, compost and mulching materials are in short supply. There is also concern that mulching and compost making are not only unsustainable, but they also have a negative impact on the environment. Currently, most of the grass for mulching and composting comes from wet areas – a practice that threatens the future of the wet areas.

Conclusions and recommendations

Farmers involved in the students' projects benefited from training and encouragement to improve management of their crops. In one area, farmers formed work groups to share labour on labour-intensive tasks like bund construction. In another area, the student organized good farming competitions and awarded prizes to the best farmers. Despite these successes, the study reveals the importance of understanding farmers' objectives in selecting and using technologies. For example, many of the current specifications for contour bunds and mulching in banana based cropping systems, though desirable, are not essential as farmers' concerns are more about moisture conservation, weed control and soil fertility improvement. Criteria for

effectiveness of techniques used should therefore seek to check if these farmers' objectives are being achieved. In established banana plantations, for example, strictly following the specifications for bunds (layout, spacing and dimensions) would lead to a lot of distraction of banana plants which may not be a necessary loss if the purpose is only to conserve moisture.The major problems in implementing soil and water conservation techniques are labour and lack of compost and mulching materials. In addition, because bananas are essentially a staple food crop whose market value fluctuates, farmers find it difficult to invest their limited financial resources on the crop. Future extension efforts will therefore need to consider labour-saving methods and methods of increasing herbage from within the farm before further significant improvements in application of the two techniques can be expected.

The study also reveals the difficulties in assessing extension outcomes, especially where extension recommendations tend to be broad and less specific. For example, though multiple cropping and agro forestry are important soil and water conservation techniques, current extension recommendations and objectives of these techniques are still too vague to be used for assessing evidence and effects of extension efforts. It is therefore recommended that more research be done on the two techniques in order to come up with clear extension recommendations.

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