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Annex A

This annexe is a scientific report of the research conducted under project R7517. Included here is detail of the rationale and thinking behind the research approach and activities.

Contents

1. Introduction

Since the early 1990s continuing to the present day, Uganda has been regarded as something of a success in terms of economic growth and poverty reduction. Though the macro indicators in the agriculture sector are generally positive (Uganda 2000a) it is believed that large proportion of the recent production gains are more as a consequence of expansion in area cultivated rather than improved productivity (i.e. yields per hectare, Uganda 2000b, World Bank 2001). Current policy recognises that the majority of poor Ugandans are rural farmers and identifies productivity improvements as key to improving their livelihoods. Soil management is highlighted in national policy documents as a key concern, particularly in the high potential hilly areas in the south-west and east of the country (Uganda 2000b).

1.1 Local demand

Although initial interest in undertaking this research was stimulated by the NRSP call and soil management was clearly high on the national agenda, it was important to confirm local demand in the eastern Ugandan hillsides for the research proposed by R7517. Prior to the project, local studies (Semalulu *et al*., 1999; White, 1999) had reported that soil-related constraints, specifically fertility decline and erosion, were highly ranked by local people amongst their production constraints.

The project inception workshop in early 2000 confirmed a strong demand for practical and relevant support to local professionals and farmers in the area of soil management (McDonagh et al. 2000. Annex B). During this workshop the following needs were identified from the attending stakeholder groups (farmer representatives, local extension agents, NGO field officers, local Government officials and researchers):

- Specific demands from the extension officers and NGO field workers (the "local professionals[1]" (LPs) targeted by this research) group for practical diagnostic kits to help them identify soil and crop problems, in particular, nutrient deficiencies.
- The need for researchers to better advise farmers on fertilizer recommendations, agroforestry and a range of other soil management options.
- Increased contact between researchers and local professionals as this is currently limited or, in many cases, non-existent with much of the available

[1] Local professionals (LPs) are the professionals working in the field with soil management. These include the Government agricultural officers (extension officers) and their assistants; soil and agricultural officers working for externally and nationally funded projects and NGOs; and the emerging private sector providers of soil management advice in Uganda.

information out-dated or inappropriate for the environments in which LPs and farmers are working.
- A more flexible, adaptable format for the information and support provided by LPs to farmers.

(McDonagh *et al.* 2000, Annex B).

1.2 The research assignment

The NRSP call invited research that helped local professionals (hereafter referred to as LPs) identify "best-bet" and "win-win" strategies for soil fertility management. This informed the project purpose, which was:

> "*Means for local professionals to identify "best bet" and "win-win" technologies developed and targeted to relevant communities/households through use of improved biophysical and socio-economic analytical tools and approaches"*

Implied in this title is an emphasis on tools that the **local professional can use** that help with **targeting support** to different groups of people and that enable the LP to offer an **improved service** – to identify strategies and otherwise advise farmers more effectively than they can at present. The research was not directly concerned with the development of new technologies, rather the premise was that there was a great deal of relevant information on soil management in the research domain that LPs were unable to access. Thus part of the research assignment for R7517 was to collect together and repackage existing information into forms that LPs can use.

1.3 Poverty focus and guiding principles

This research fits well into the context of poverty reduction in Uganda. Though doing better than some countries in the region, Uganda is one of the low income-economies in SSA and is among the poorest countries in the world. Poverty is most pronounced in rural areas, particularly in the north and east and this contributes to food shortage, child malnutrition, frequent illness, high rates of HIV/AIDS (MFPED, 2000) and widespread illiteracy. Although there has been an overall decline in numbers of poor in recent years, farming households still account for 80.6% of the total (Appleton, 1998). Current macro policy in Uganda has a strong poverty focus (Uganda 2001), including in the agriculture sector (Uganda, 2000b).

There was a consensus in the inception workshop plenary discussions in two areas directly concerning poor subsistence farmers. Firstly, the majority of the soil management help advice LPs gave to farmers was not appropriate for the low input subsistence farming practised by the poor small-holder farmers in eastern Uganda. Secondly, these subsistence small-holders comprised the over-

whelming majority of the rural farming community[2]. This is reflected nationally with smallholders dominating the agricultural sector in Uganda: over 90% of crop production occurs on household farms averaging less than 2 ha (EIU, 1997). The demands expressed at the inception workshop largely corresponded with the project purpose and outputs, though some of the latter were modified in response to local demand. In addressing these demands, in focussing on outputs relevant to subsistence farming and low input systems, the research activities and planned outputs was clearly directed at the needs of poor farmers.

At the inception of the project it was envisaged that one or more of the tools developed would help LPs to identify different types of farmer, particularly poor farmers, and so be better at targeting relevant advice and support to individuals and groups (McDonagh, *et al*., 1999) This is consistent with the current trends embracing rural livelihood diversity (Chambers and Conway, 1992; Ellis, 2000) and interest in trying to target interventions through identifying recommendation domains among farmers (Dent et al; 1995, Austin et al 1998; Defoer *et al*., 2000). Though this objective was reasonable and clearly articulated in the project purpose it became clear, as a consequence of the literature review and early discussions amongst the research team, that this was unlikely to be a realistic or particularly useful aim in this research. Whilst this in no way compromised the poverty focus of the research or its outputs some elaboration of the rationale for dropping the "targeting" element of the research tools is warranted:

The need for "resource light" tools and approaches

In common with many African countries agricultural support services in rural areas of Uganda are failing under staffing and resource constraints. It was clear from early discussions with district officials (agricultural and production officers) in Mbale and Kapchorwa before and during the inception workshop that the government extension service had little operating funds and insufficient staff.[3] Yet, in most cases there are ever increasing expectations of what a LPs are expected to do. This is a consequence of the trend in developing ever more complex tools and procedures for documenting/analyzing local knowledge systems and the diversity of different farmer circumstance. There are a number of PRA-based tools for describing complexity (Garforth and Usher, 1997), e.g. resource flow mapping, wealth ranking, household resource and livelihood analyses etc., Many of these tools are participatory, requiring high level skills in managing group meetings, consensus building, data collection and interpretation etc. but LPs often lack these skills, have little opportunity to learn them and therefore lack capacity to use tools and approaches requiring them. There is some concern already about the "tyranny of participation" (e.g. Francis and Carter, 2001) but the resource capacity of the LP is still overlooked to a surprising degree during the development of new tools and approaches designed

[2] LADDER research in the region subsequently confirmed the small-holder subsistence nature of poor farmers livelihoods in eastern Uganda (McDonagh and Bahigwa, 2002, Annex K)

[3] A single Government extension worker is generally responsible for giving support to up to a hundred villages, each with an average of a hundred households.

for their use. The demand for simple easy-to-use tools emerged strongly from the inception workshop, review and associated activities and this was taken up by R7517 as a major guiding principle in its research activities. It was also anticipated that scaling-up outputs would be easier to effect with “resource-light” tools.

There is past research that has attempted to identify recommendation domains for soil management through categorizing farmers by wealth, livelihood type, enthusiasm or other socio-economic criteria and developing frameworks derived from this information. These frameworks are designed for targeting particular management options for specific environments and groups or typologies of farmers (Dent et al; 1995; Defoer *et al*., 2000). However, with R7517, it was felt that any tool that allowed the LP to target specific farmer groups, whether it was effective or not (addressed in next section below), would be relatively resource demanding of the user. The soil fertility resource guide produced and heavily promoted by KIT and IIED (Defoer *et al.* 2000) typifies the approach prevalent over the last five years that appears to be largely inconsiderate of the capacity of the LP to use the tool. Co-incidently CIAT/TSBF (based at Kawanda Research Institute, Kampala) had begun piloting the KIT/IIED guide in Iganga district in eastern Uganda at the same time as the approach of R7517 was being discussed. It would have been pointless for R7517 to duplicate CIAT/TSBF’s efforts in piloting the KIT/IIED Guide in Uganda but, even in early 2000, there were indications that the resource- and time-hungry nature of the KIT/IIED approach might be problematic. This was confirmed and the approach largely dropped a year or so later (R. Delve, CIAT/TSBF personal communication).

Is the development of an effective targeting tool realistic?

If a tool for classifying recommendation domains and targeting soil management advice and support is to be useful it must do more than identify the obvious e.g. the relative reluctance/inability of a poor farmer to take risks, invest in inputs etc. If the tool is to allow the LP to fine tune advice to fit farmer circumstance it must be derived from an understanding of farmers’ perspective on soil and its management and the basis for farmers’ decision-making affecting the allocation of resources to different activities. This demands a much more sophisticated analysis of the linkages between the biophysical, social and institutional elements of farmers’ livelihoods and the degree to which they determine the “best-bet” soil management option for an individual. A tool that does this in a way that allows the user to do more than identify the “obvious” would not only likely be “resource-heavy” for most LPs to use but also demand an ability to model farmer decision making to a degree of complexity and precision that has not yet been achieved, even at the theoretical level (Martin and Sherington, 1997; Cleaver, 1999; Bryceson and Bank, 2001). Even the more complex (and less user-friendly) models are poor at modelling anything but the main system components (e.g. Castelán-Ortega *et al*., 2001).

At the same time as it was becoming clear that the development of an advice/support "targeting" tool was not realistic the research team became increasingly convinced of the potential role of farmers in selecting and fine-tuning their own management options. Even with sophisticated frameworks for classifying farmer and farming system diversity, the farmer is the only person who can say for sure what her/his best-bet option might be and he/she will generally only be able to say this after trying it out. So, farmer *participation* and *experimentation* come through as necessary and important when trying to identify "best-bet" and "win-win" soil management options. The research assignment was thus broadened to include tools and approaches facilitating farmer involvement in identifying, testing and modifying soil management options. The objective of producing specific decision support tools for targeting appropriate soil management and LP advice was de-emphasized during the first year [4] and then consciously dropped approximately mid-way through the project. A brief section on recommendation domains was included in Part I of the resource guide (section 2.2, McDonagh *et al.* 2003) as some of the concept is likely to be useful for discussion wit LPs.

1.4 Linking with policy

As part of its poverty reduction strategy the Government of Uganda (GoU) has embraced decentralization and a cross sectoral approach to rural development, articulated in the Plan for Eradication of Poverty (PEAP, Uganda 2001). The flagship policy in the agricultural sector is the Plan for Modernization of Agriculture (PMA, Uganda 2000b), developed in the late 1990s and consistent with the cross-sectoral and decentralized approaches advocated in the PEAP. The PMA advocates a move from largely subsistence to technology based export-oriented agriculture through a broad range of cross-sectoral initiatives. Although adopted nationally the district and sub-county administrations have the power to commit funds to whatever they believe will best enhance poverty eradication. By not forcing local administrations to spend predetermined amounts a much more sensitive allocation of resources should be possible, to where the need is greatest. There are casualties however, with this flexible approach to funding, and it was clear that the Agricultural Extension Service (AES), in Mbale and Kapchorwa had been losing out since 1997 with administrations spending most of their resources on roads and education. Broad dissatisfaction with the AES, its outdated mode of operation and the high cost of running an effective service has driven the development of the radical new proposals for agricultural service delivery in Uganda, embodied in the National Agricultural Advisory Services (NAADS) policy framework.

[4] Tools for targeting information provision and identifying recommendation domains do not figure strongly in the review as it was clear that those in existence did not really work and were generally resource demanding. However, at this early stage the research team was reluctant to completely drop the aim of producing such tools. This became logical later when the potential role of farmers themselves in selecting and fine-tuning management options was clearer

The NAADS is a cornerstone of the PMA. It's vision is of an almost fully privatized extension service with groups of farmers forming around common interests at village level, communicating their agricultural support needs to farmer "fora" at sub-county level where needs are prioritized, passed onto the district for further prioritization and the production of a short list of issues that form the basis of tenders to the private sector service providers. The final policy was approved early in the lifetime of R7517 and, by project end, some sub-counties in approximately half of the districts (though not Mbale or Kapchorwa) in Uganda had begun to pilot NAADS. Before a district could begin to pilot the NAADS policy it had to undertake to dismantle the existing Government extension service. Importantly the LPs within NAADS are destined to be the same group of people as the current LPs, i.e. largely ex-extension officers re-trained to provide their support through the private sector. In deciding to work in partnership with existing extension officers in designing the tools and approaches R7517 was also confident that it was working with essentially the same group of people the would be supporting farmers within the NAADS framework.

It was clear in 1999/2000 that the policies of decentralization and the cross-sectoral approach to rural development was, if anything, reducing the resources available to the LP and it seemed unlikely that this situation would change markedly even under NAADS implementation. Thus awareness of the policy environment in Uganda increased the commitment of R7517 to developing "resource-light" tools and approaches.

2 The research team and location

Early on a decision was made to focus on hillside areas in the east of Uganda, in Mbale and Kapchorwa Districts, as a substantial amount of soil-related work had been done or was ongoing in south-west Uganda, but relatively little in the east. The project employed a research assistant (RA), through NARO, based in Mbale to manage day to day activities in the field. The RA was the main "research" contact for the LPs and spent his time visiting the LPs in the field, helping them test the tools and establish activities at village level. The DEV/ODG researchers participated mostly in the research planning and formulation, tool development, writing of presentations and papers etc. and the short but frequent workshops in the field in Uganda during which the tools were tested and refined.

The project purpose clearly targets LPs and their capacity to support farmers in soil management thus it was important to involve these LPs in the project research. The NAADS proposals (see section 1.4 above), and the likelihood that the days of the AES were numbered, were on the table from the project outset, nevertheless, it was apparent for the reasons outlined above that they should be important research partners. Initially this was a challenge as the AES was broadly perceived as a tired, ineffective and increasingly irrelevant institution. Within it, however, were very substantial human resources and most of the field level expertise and experience in agricultural support in Uganda. The AES in Mbale and Kapchorwa engaged fully and enthusiastically with the research.

The project also formed a strong collaborative link with the Mount Elgon Conservation Project (MECDP), and latterly with the Africa 2000 network[5]. Members of MECDP collaborated throughout the project in all aspects of planning and tool development.

The project worked in two sub-counties in each of Mbale and Kapchorwa Districts. Working with representatives from the District Agricultural and Production offices from Mbale and Kapchorwa and with staff from MECDP, four sub-counties were identified as the most appropriate areas in which to focus project activities. These were Bududa and Butiru in Mbale District and Chesower and Sipi in Kapchorwa District. Access, degree of involvement with existing NGOs etc, the importance of soil fertility/soil conservation as a key constraint (identified in White, 1999) were important criteria in making this selection. The four AES field officers for these sub-counties became key members of the project team. For the reasons outlined above (section 1.3) none of these officers had significant operational funds so the project facilitated their day to day activities while they were working with the project. This consisted of providing all inputs required for extension work (e.g. seed, napier grass planting material etc.), reimbursing fuel for motorcycle use, covering cost of farmer to farmer visits and payment of the standard government per diem for days spent in the field. Facilitation was performance related and in order to receive it the extension workers had to submit work plans in advance and stick to them. Performance and facilitation was monitored and administered by the RA and the Dr Semalulu (NARO, Kawanda).

In two of the four sub-counties the extension workers already had a high standing among the local community at the start of the project and relationships with villagers were good. In the other two sub-counties the relationship was not so good and the project had to work on improving this to make real engagement with farmers in the process of tool development possible. To do this the project helped each village address one or two land degradation problems affecting communal areas, generally small gullies and other run-off damage on the roads and communal areas in the villages. Retention ditches and soil traps were constructed working with the LPs and villagers with the project paying for some tools and the village supplying the labour, though the project also paid for the labour the first time this was done. These activities were generally very successful in addressing the problem but also in generating interest and goodwill for the project so serving as entry points for the LPs and additional project activities. Subsequent village meetings were always well attended with a high level of motivation usually shown by villagers for project-related activities. This strategy of using entry points was discussed with and appreciated by the extension officers.

[5] Dr Semalulu ran a workshop in Spring 2002 on the “tools and approaches” of R 7517

3 Methods

R7517 set out to develop tools and approaches to satisfy the demands expressed by LPs and farmers in Uganda (at the project inception workshop, Annex B and in early discussions with LP team) and identified in the literature review. These are summarised in Table 1 below. Tools were drafted, tested and refined in an iterative process through workshops and through field activities with the RA and other members of the research team in the focus communities. This process was generally as follows:

i) The researchers would suggest one or more formats for a tool or approach e.g. a method for involving farmers in experimentation around a theme of common interest. These suggestions arose from the expressed demand, discussions with the research team and the activities associated with the first project output (discussed below in section 4).
ii) The tool/approach was drafted, generally by researchers at UEA.
iii) The draft tool/approach was introduced, discussed at a District workshop, tested in the field if relevant and then modified and re-drafted to make it clearer, more user-friendly or more useful to the LP.
iv) The tool was then tested by the LP working with the RA in the field, and occasionally with the whole research team on a field day connected to a project workshop.
v) The tool would be modified further and discussed/tested again until the LPs were happy with it. In some cases, e.g. with the guide for financial appraisal of soil management measures (Resource Guide part II), this process took a long time.

Village and District workshops were key activities for the development, testing and discussion of project outputs. Village workshops were held regularly in the project villages (three times a year on average) with participation of researchers, extension workers, village leaders and farmers. These workshops allowed the researchers and LPs to test some of the tools and approaches with farmers and receive feedback from these activities and more generally from LP activities in the community. Village workshops were conducted in conjunction with farmers' field visits. District research workshops were held when each round of village workshops was completed, with the participation of researchers, extension workers responsible for the project villages, District Agricultural and Production officers, and MECDP staff. The district workshops enabled the project team to synthesize the specific situations and experiences from each of the project villages and integrate this information in the process of refining the tools. With the active participation of local Agricultural Officers, the district workshops also brought in the views of local leaders and policy makers and promoted local institutional ownership.

Most of the tools and approaches (Output 2 discussed below) were thus well tested. Others, particularly those for which the need had been identified rather

late (e.g. the protocol for tree planting) were only briefly tested in the field. All were approved by LPs at workshops, however. They were packaged together into Resource Guides I and II (Annexes E and F) several months before the end of the project.

Two surveys were also conducted to support the research. The first was a field survey conducted early in the project designed to collect baseline data on farmer assets, farming practice and perspectives on soil management. The second was designed to investigate the uptake, adoption and adaptation of R7517 products in the project communities. The survey methods are discussed in the relevant reports (Annexes B and G) and the results are discussed in the next section.

4 Project Outputs

The planned outputs of the project (revised after MTR) were as follows:

1. An integrated understanding of local and formal research- generated knowledge on SFM & SWC gained. The implications and resource requirements for farmers' implementation understood.
2. A package of tools and approaches for assessing SF status, selecting/fine-tuning SFM options and assessing the position of farmers viz. a viz. SFM developed and locally tested.
3. Results of project communicated and wider applicability investigated and identified.
4. Institutional capacity for effective Research-LP collaboration in SFM in Uganda increased, particularly in project area.

These are discussed in order below:

4.1 Output 1: understanding gained

The activities associated with this output included a literature review, a field situation survey and a participatory assessment of the resource requirements for practising different types of soil management. This last activity took place during a workshop with the research team (including LPs) in 2001 in Mbale. The MOVs generated were the review document, a survey report and teaching and decision support tools for considering the resource requirements for soil management and identifying appropriate management options (Tables 12 and 13 Lu *et al.*, 2003a, Annex E).

4.1.1 The literature review

The primary objective of the review was to facilitate research planning and inform the development of tools and approaches for the project. The review document was disseminated for comment in a modest way (i.e. to fewer than 10 individuals) in Uganda and the UK. It was not meant for publication or wider dissemination.

An important part of the review was defining the job of a soil management LP. It is evident from the project outputs that early on R7517 broadened its focus,

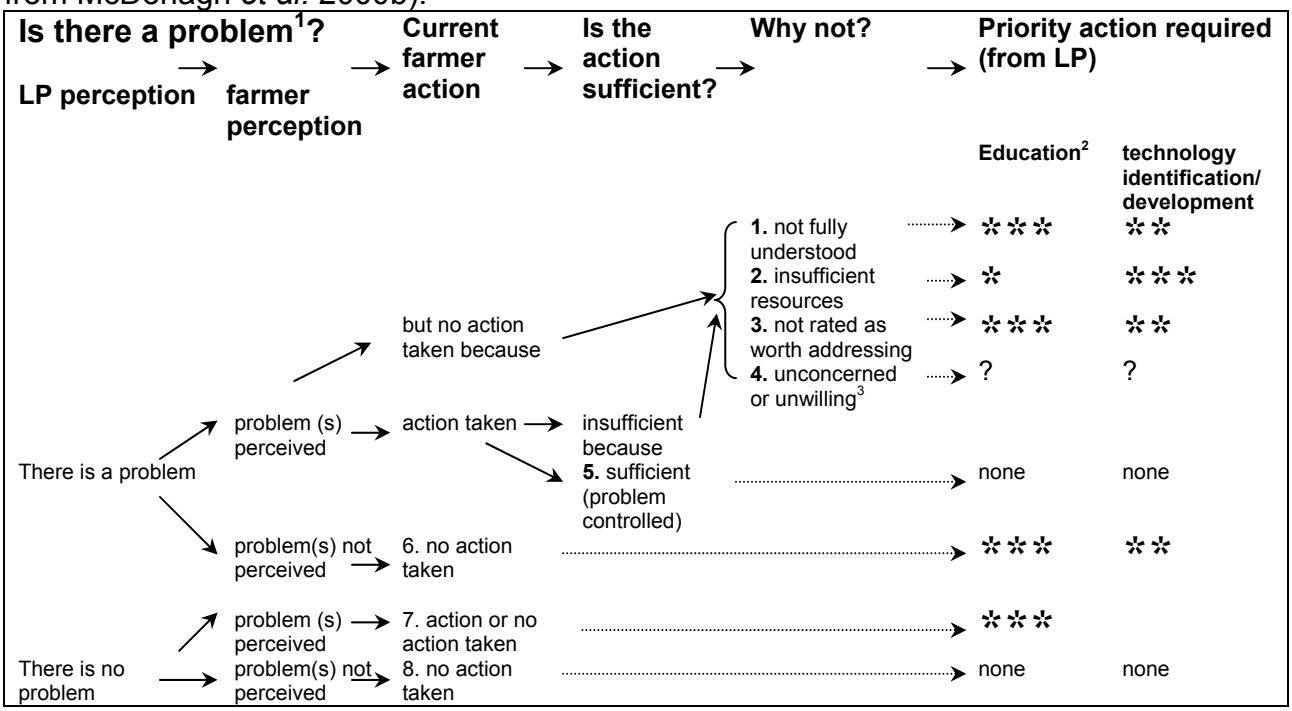
recognizing that an LP should be able to do more than just identify technologies for farmers, but also facilitate learning and on farm research where required etc. and that tools and approaches are needed for all of these. The need for this broader perspective came partly from the inception workshop (McDonagh *et al.* p4, Annex B) but also from the review and the thinking it stimulated in the research team (McDonagh *et al.* 2000b, Annex C). Table 1 and Figure 1 (they are Table 2, p5 and Figure 1, p6 respectively in the review) became important frameworks for subsequent research planning. Table 1 describes the different aspects of the job of the LP and categories of tools and approaches required. Figure 1 is a decision support aid demonstrating the importance of the education role of LPs in their work with farmers. They were discussed at length in the first workshop held with the project LP team and there was strong agreement that this broad perspective on tools and approaches required by LPs should be taken.

From the review also came a number of guiding principals concerning LPs and their requirement for tools and approaches that informed the subsequent research: the importance of characterizing the "LP" and recognizing their constraints (p 4); the nature and extent of the tools and approaches required by LPs (Table 2, p 5; copied here as Table 1, below); the need for tools to help to educate farmers as well as identify appropriate soil management options (p 6); the value of tools that help link soil related indicators to severity of a soil-related problem (p 8) or link form of management to impact (p 15); the lack of information in relation to nutrient deficiency identification (p 10); the value of locally important indicators (p 12) etc. Skepticism was also expressed over some of the approaches currently dominant in available tools and approaches, in particular the nutrient budgeting and flow analysis techniques promoted most effectively in the KIT/IIED resource guide (Defoer *et al.*, 2000).

Table 1 Requirements of the LP working in a (new) field or community. This research has been focussing on the development of the "tools" identified here (copied from McDonagh *et al.* 2000b)

Objectives	Knowledge and tools required by LP
1. *Problem identification*: • Are there any soil management problems here? • If so, how pressing are they and are farmers aware of them? • How important are natural resources generally and soil in particular in people's livelihoods?	***Knowledge:*** • signs and symptoms of erosion and soil fertility decline • livelihood characteristics of the community ***tools:*** • field methods for identifying problems (nutrient deficiency and land degradation guides). • protocols for holding group meetings, area walks, identifying and prioritizing soil problems in the community. • decision support to determine what sort of activities are required (primarily teaching or farmer-led experimentation) • economic analysis tools
2. *Teaching and learning about*: • Key soil properties and processes, • Common problems and their causes • Local soil management	***knowledge:*** • soil structure, function and processes, roles of main nutrients, causes and effects of common soil problems. ***tools:*** • aids for teaching farmers in signs and causes of soil problems – posters and other visual aids, resource flow mapping techniques, farmer to farmer visits etc. • protocols for holding structured group meetings and prioritizing soil related problems.
3. *Solution identification*: • How can the farmer address the problem(s)?	***knowledge -*** *for different problems to understand the* • extent to which they can be resolved. • current approaches to resolving them • most appropriate generic solutions and a number of adaptations farmers may like to experiment with • costs of adopting solution (land, labour, cash, knowledge etc.) ***tools:*** • decision support tools
4. *Fine-tuning*: • How to help the farmer adapt/fine-tune the new management option to suit the local conditions?	***Knowledge*** • guiding principles for on-farm experimentation: simplicity, small-size, reducing variation, isolating variable of interest. ***tools:*** • framework and protocol for facilitating, monitoring and evaluating farmers experiments. • inputs (seeds, seedlings, contour measuring instruments, fertilizers) in small quantities to give to farmers for experimentation.

Figure 1. Moving from problem perception to action in soil management (copied from McDonagh *et al.* 2000b).



[1] a "problem" can be defined here as a soil related issue affecting productivity sufficiently to require management attention.
[2] the word education is used here to indicate some form of training, awareness-raising activity is important.
[3] a farmer may not be unconcerned or not prepared to invest in soil management because (s)he is not the owner of the land or tenure is not secure.
* represents relative importance of different types of activity.

Backstopping support

As R7517 progressed it became apparent that there was a separate back-stopping element lacking, particularly for the AES but also generally with soil management professionals in Uganda. By "backstopping" we mean support and training activities for LPs to keep them generally informed and up to date but also trained in the use of new tools and approaches. Thus some of the project tools and approaches (particularly in Part I of the Resource Guide; Lu *et al.* 2003a) are intended for use in training LPs in the theory and thinking behind the use of tools they might use in the field with farmers. Part I has been developed during a series of workshops with the project team and is intended for use in District or National level training workshops that could be held to introduce and disseminate the field tools more widely in Uganda. These outputs are discussed further below.

4.1.2 The Field (situation) Survey

The purpose of the survey was to understand local perceptions and knowledge around soil and the local context in which the tools and approaches were to be developed and tested. It focused on the following:

1. The characteristics of the farmers likely to influence their soil management.
2. Farmers' production activities and soil management practices together with their assessment of the effectiveness and weaknesses of different management options.
3. Farmers' perspectives on the main problems in crop production, and the constraints that prevent them from taking proper actions to address these problems.
4. The sources and types of technical information on soil management currently available to and expected by farmers.

The objectives of this first survey were to obtain a baseline dataset, stratified by wealth, covering assets and activities in the four main study communities (Lu *et al.* 2000, Annex D).

Unsurprisingly variation was found between households in their access to assets (labour, land, techniques, capital etc.) and livelihood strategies, and this variation clearly affected farmers' soil management practice in a number of ways. The survey also found that the demands of the community sampled were consistent with the purpose and developing approach of the project i.e. the resource poor nature of most of the community and the high ranking given to soil related production constraints. Farmers were naturally more interested in measures that provide quick returns and that are less input demanding or for which required inputs are locally available.

Informants also provided a long list of local indicators regarding different soil problems. These local indicators were used to help with the development of the tools for field assessment in order to increase the local relevance of the tools and guides. Although farmers tend to obtain soil management knowledge from multiple sources including parents, fellow farmers and schools, the extension service was viewed by farmers as a potentially important source of new information, though one that has been largely failing for the last decade or more. This observation reinforced our commitment to work with the AES.

Shortly after this survey a livelihoods survey was carried out in several of the project villages in collaboration with the DFID PRP funded LADDER project
The results of the LADDER research have been reported elsewhere (http://www.odg.uea.ac.uk/ladder/) but one of the initial research objectives of R7517 was to use the results of this survey to help address farmer and farming system complexity by developing tools that allowed the LP to tailor activities and advice to farmer circumstance (wealth, access to resources, farming system etc.). For the reasons discussed in section 1.3 above, this was dropped as an objective.

4.1.3 Assessment of soil management options

Through workshops with farmers, extension workers, district and sub-county officers, different soil management options were reviewed and assessed in terms of their objectives, limitations, resource requirements, accessibility constraints, and the different ways in which they could be applied in the Ugandan hillsides

context. The indicators and criteria used for the assessment were agreed during discussions between different stakeholders. The results of the assessment of different soil management options were tabulated (Table 12, p 29 part I of the resource guide, Lu *et al*., 2003a, Annex E) and may be used as a discussion aid or possibly as a decision-support tool for selecting appropriate generic interventions most relevant to communities. This is not a particularly sensitive decision support tool, however and is not designed to identify recommendation domains within a community. It is unlikely to tell an experienced LP anything (s)he does not already know but its value is more in reminding the LP of the important links between farmers' resources and their land management.

4.2 Output 2: tools developed and tested

A number of field tools, decision support aids and protocols were developed and tested within the framework already presented in Table 1.

Part I (Lu *et al.* 2003a, Annex E) consists largely of technical background supporting the field guide (Part II). However, in addition to the technical information regarding soil management, this section includes a number of participatory methods for collecting and analyzing relevant information for soil fertility management, such as yield trend analysis, financial appraisal of soil management options and protocols for on-farm experimentation. These methods have been illustrated with local examples and have been tested by researchers and LPs with farmers. Part I contains support materials for the LP to dip into but has primarily been designed to form the basis of a short LP training workshop where the theory and more complicated tools and approaches can be introduced and discussed. The lack of back-stopping support for LPs in Uganda (mentioned in 3.1.1 above) is marked and persists under the NAADS framework (Otim Nape, and Kisauzi personal communications[6]). Soil management workshops held at district level would be a relatively inexpensive way of scaling-up R7517 outputs and Part I contains the resources for such work-shops. A condensed review of the options for soil management in the Ugandan hillsides is included for use as a decision support tool in Part I of the resource guide (Table 13).

Part II of the Resource Guide consists of field guides (Lu *et al.* 2003b, Annex F) that share the following features:

- They are largely visual with a simple format and text supported by figures, photographs etc.
- They are locally relevant with local indicators, images (photographs) and management options incorporated where possible.
- They are practically oriented, linking field assessment of a problem to intervention recommendations.

[6] Dr Otim-Nape was head of the NARO outreach programme at the time of meeting (August 2002). Dr Kisauzi is a Ugandan, Kampala-based consultant who has worked on the NAADS proposals and also for DFID NRSP on strategies for scaling up its outputs.

Twenty-three visual guide sheets were produced covering nutrient deficiency identification, soil erosion assessment, options of soil fertility management and financial assessment of different options. These visual guides have proved effective in facilitating the communication between LPs and farmers on issues of soil management. They have been laminated and collected together to form a field guide for LPs (attached as Annex F and in electronic format on accompanying CD).

A strong demand was expressed for tools to help LPs and farmers identify nutrient deficiencies in key crops: banana, maize, coffee, beans (McDonagh *et al*. 2000, Annex B). As a comprehensive field guide to bean nutrient deficiencies is available in Uganda (Allen *et al.,* 1996) this project concentrated on producing a few (six) simple visual guides for identifying key (nitrogen, phosphorus and potassium) nutrient deficiencies in banana and maize. Importantly these were linked on the field sheets with information on options for addressing these nutrient deficiencies. Effort was taken to ensure that these management options were locally relevant, that at least some were accessible to most farmers covering both organic and mineral fertilizer based options.

These nutrient guides have been well received though there is demand for something more comprehensive, covering more crop species and diseases in addition to nutrient deficiencies. Resource constraints aside, the project was reluctant to go too far down this route as any comprehensive guide to nutrient and disease deficiency symptoms, their interactions and options for management would probably be too complex for most LPs to use, even with basic training. Thus we deliberately held back from this, restricting ourselves to covering the major nutrients (N, P and K), deficiencies of which are extremely common and often responsive to single factor interventions (e.g. legume cover crops for N deficiency, rock P for P deficiency).

The process of drafting and redrafting field tools depending on LP input helped to ensure that the end product was something they feel comfortable using in the field. The feedback from the Results Communications Workshop (Annex H and section 4.3 below) supported this and the Uptake and Adoption survey indicated farmers had increased their soil management activities in the project communities over the lifetime of R7517 and that there had been an improvement in the service form LPs. There were shortcomings with this survey, however and these are discussed in the next section.

The approach and format we have used by R7517 to develop the field guides (Resource Guide, Part II) could be used to produce similar guides for additional crops, management options etc. There was a demand for this expressed from several sources at the end of project (EOP) workshop (see section 5. below).

Fifty copies of the Resource Guides (Parts I and II) were distributed to relevant institutes and individuals (recipients listed in Annex I).These were produced at

relatively high cost in the UK but further could be produced much more cheaply in Nairobi (and possibly Kampala). All guides are lodged electronically with NARO and the files are available free of charge from the NARO Soils Division. NARO is going through radical restructurings at the moment and the outreach Division may survive. If it does the guides will also be made available to this section by the Soils Division.

4.3 Output 3: results communicated

The project kept in touch with a number of organizations, in addition to those collaborating on the research and in this way informal results communication went on throughout the duration of the project. A good example of this is a n invited workshop run by Dr Semalulu for the Africa 2000 Network in Spring 2002 on the use of R7517 products.

A formal results communication workshop was held at the end of the project (2/4/03) in Mbale (Annex H). The project outputs were presented to a wide range of stakeholders (listed in Annex I), the outputs were discussed and feedback was collected. The applicability of project results was investigated from two perspectives, firstly the value of the products and secondly, possible strategies for further disseminating and scaling them up.

Table 2 summarises the feedback from 31 participants of project workshop and this is indicative of the wide applicability of project results. There was clear indication from the workshop that the project outputs could be used for a wide range of purposes by different stakeholders.

Table 2. Applicability of project outputs identified by different stakeholders

Value of the project outputs	**Uses of the project outputs**	**Potential users of the project outputs**
• Simple and properly illustrated • Relevant to the situation on the ground • Communities' participation shows sense of ownership of the tools • Durable packaging	• Facilitating farmer participation in identification of soil fertility problems and solutions • Teaching, training material for short courses, farmer field schools • Sensitizing local leaders farmers • Africa 2000 Network (NGO) training programs	• NGOs, Training institutions for agriculturalists (e.g. Makerere and Nkozi Universities and National agriculture colleges) • Students • All extension and service providers • Farmer forums in NAADS districts • Community leaders

A number of suggestions for possible scaling up strategies and further research work in the area were made by workshop participants – these are discussed in section 5.

4.4 Output 4: institutional partnerships and capacity building

This output was added to the log-frame after the MTR. Less tangible as a research product it aimed to increase institutional capacity for effective Researcher-LP-Farmer collaboration.

This research fostered the Research-LP-Farmer partnership at two levels. Firstly the project team itself was a partnership of researchers, extension officers and farmers. Secondly there was the professional linkage between the research team and other stakeholders. Table 3 lists the partners and the nature of the partnership established by the project. In this partnership farmers are key in identifying and assessing soil related problems, assisted by LPs; farmers make the final decisions on which soil management should be taken and lead the fine-tuning/on farm research process; the LPs are the facilitators supporting farmers' soil management decisions and the partnership they have with formal researchers (NARO) allows them to do this effectively.

Table 3. Partnership established through the project

Project Team	**National Institutions (NARO, MECDP Universities, AHI)***	**Local Institutions (DFIs, DAOs)***	**LPs (extension officers, NGO workers)**	**Farmers**
Included researchers from international and national institutions, LPs, and farmers working with the project	As active team members; informed about the objectives of the project; some research products target these national institutions	Involved in the development and modification of the tools; participated in workshops and field visits; integrated the project field activities into other demonstration programmes	Active team members; linking farmers and researchers; disseminate and utilize research products	Actively involved in the project, share their knowledge on soil assessment and management, test and modifying soil management options.

*NARO – National Agricultural Research Organisation; MECDP – Mt. Elgon Conservation and Development Project; AHI – Africa Highland Initiative; DFI – District Farming Institute; DAO – District Agricultural Office.

Key elements of the capacity building success were:

- The presence and evident interest of NARO researchers to interact with officials and LPs at district and sub-county level and in the field.
- The medium-term commitment of the researchers and project to working with the LPs and local agriculture/production offices at district level.

- The highly inclusive nature of the research activities. There were open invitations at district and sub-county headquarters for those interested in soil management to attend.
- The "low-key" nature of the workshops, field visits and all project interactions. This informal atmosphere encouraged broad participation in all activities.
- The permanent presence of the research assistant (RA) in Mbale and monthly (minimum) contact with the LPs. This was particularly important for the project research activities as the RA oversaw the testing of the tools and approaches and provided feed-back to the rest of the research team. It is unlikely that it will be possible to have this level of LP backstopping support throughout Uganda but hopefully it will be possible for the restructured NARO to provide some level of researcher support to LPs from the District Farm Institutes.

4.4.1 Linkages with DAOs, NGOs, NAADS and other projects

During its activities, the project worked continuously with District Agricultural Officers (DAOs) and, through them, there was collaboration with District Environment Officers, other related projects and NGOs. By working through these existing structures, the channels are open for any scaling up of project activities and/or outputs to other (NAADS) districts.

5 Impact and evaluation of project outputs

Direct and indirect assessment of the impact of R7517 outputs was attempted. It was felt that the involvement of the LPs working with project was too great to allow them to give a meaningful, objective assessment of the products.

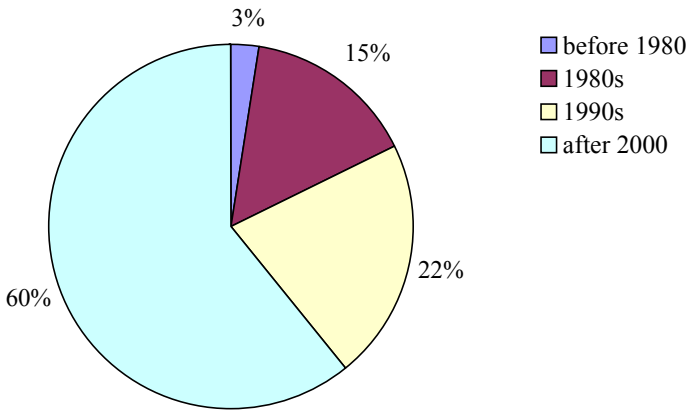
5.1 Uptake and adoption survey

An indirect assessment of R7157 products was carried out in November 2002 in the form of a survey of farmers in the project communities (Annex G). 15 households were randomly sampled in each of the eight villages in which R7517 had been active (Annex G). There were some problems with the survey implementation and consequently it did not target the same individuals surveyed in the situation survey (Annex D). Therefore, a direct 'before and after' project comparison was not possible, nor was it possible to carry out a "wealth sensitive" impact analysis as had been intended. Tracking the impact of individual products and separating this impact from the effect of having generally more enthusiastic and active extension workers in the communities is difficult to do and was not possible either in this survey. However, a number of clear impacts were identified. In particular the increased engagement of people with soil conservation (Figure 2); increased reliance on extension officers compared with the initial survey results; the value attached to multipurpose management options and some examples of farmer experimentation with farmers modifying/fine-tuning practices to suit their specific situations.

Although a "wealth sensitive" analysis was not possible the survey sample was random and we know that the majority of the people in the communities are poor marginal farmers (McDonagh and Bahigwa, 2002; Ellis and Bahigwa, 2003). The

figure of 60% engagement with soil management activities is encouraging and suggests the products were meeting the needs of the poor subsistence farming majorities in these communities.

Figure 2 Change in % of farmers claiming to practise soil management over time (n = 120)



5.2 Results communication workshop

During the results reporting workshop the project products were reviewed by the different stakeholder groups: NGOs, DAOs (they have an important co-coordinating role within NAADS), researchers and LPs, most of whom had not been working with the project. Comments were generally positive from all groups (summarized in Table 4, full report in Annex H). The researchers (mostly from Makerere University), NGOs and agriculture teaching institutions viewed them as valuable teaching and reference material worth incorporating into their training programs. Several suggested the scope could be widened to include other crops and systems and agro-eco zones.

Table 4. Comments on project materials from stakeholder groups. (From R7517 results reporting workshop, FTR Annex H)

Group	Value of material	Gaps	Scaling-up options
NGOs	- good starting point - simple tools (properly illustrated) - make important information available to users	- nutrient guides limited to banana and maize, what about other crops? - lack of policy integration into the tool application - could translate into local units/measures	- could translate into local language - publication of the tools in the format that can be easily and widely disseminated (posters, calendars, booklets etc.) - project team could create wide partnerships for dissemination, validation and further development - should be an open dissemination policy as long as the source is acknowledged
DAOs	- tools developed are relevant to the situation on the ground - simple, precise and easily understood by LPs and average farmers - tools were developed in situ and using local materials based on participatory approaches - communities' participation shows an advanced sense of ownership of the tools, thus they are acceptable and sustainable - should result in sustainable and improved soil productivity for increased farm output	- advocacy for formulation, and effective enforcement of relevant bye-laws - simple soil fertility analysis tools (e.g. soil fertility levels, nutrients application rate would be useful) - lack of strategies for green manure/cover crop seed multiplication - pests not covered	- LP training required - use of relevant mass media - translation into local language - exchange farm visits - drama/role play/music/cinema shows/exhibits - field demonstration days, - increasing/provide for adequate resources to relevant stakeholders (DAOs, NGOs, extension, policy makers)
Universities/ Research institutes	- useful tools for university/research/ARDC outreach: could easily form the basis for teaching materials. - provides basic –simple information on soil/technology - durable packaging - attractively illustrated	- information on other agro-ecological zones, cropping systems/soil types (e.g. crusting, cracking soils) - aspects of land use recommendations for different slopes	- training required in use of tools - could be supplied to schools - cheaper production of products required - could be used to give support to service providers under NAADS - could be usefully taken up and used by related projects
Extension workers	- tools empower LPs to deliver appropriate information to farmers - enable LPs to easily identify soil fertility problems - can be used by some farmers directly - the layout enables farmers to appreciate the technology	- socio-economic factors (a) ownership – land control (b) cultural believes (c) gender - identify cover crops that act as food, food/fodder, fuel, conserve fertility - produce presentation materials to include slides, films and videos.	- introduce cost-sharing to increase the outputs, cover more crops etc. - translate into local language, sign language set up publicity

5.3 Further dissemination and opportunities for scaling up

There was clear demand expressed for further copies of the materials developed and continuing development of the tools, particularly the visual guides (Part II), to broaden their scope. Some clear opportunities for scaling up R7517 outputs also emerged from the meeting:

1. Mr James Kalange, District NAADS coordinator for Tororo District has requested we make the guides available for the NAADS provider training activities in his district. He would also like the project team to deliver the training if possible – in NAADS districts (i.e. where NAADS is being piloted) these activities tend to be coordinated by the DAOs. One of the main constraints with NAADS on the ground is lack of supply side capacity. It has been agreed by farmer groups in Tororo and other districts that soil-related constraints are cross-cutting issues and any provider should ideally have competence in this area. He sees value therefore in having a strong soil management component in their training.

At higher levels in the NAADS Secretariat there is a strong focus on improving capacity on the demand side at the moment (e.g. the ability of farmers to articulate their demands) with less attention given to supply side capacity. The strategy in Kampala seems to be to devolve much of the responsibility for making NAADS work to the districts and see how things play out. The DAOs are frequently responsible for NAADS implementation in the districts as they generally coordinate provider training and are responsible for monitoring and controlling quality of service provision. The DAOs for Mbale and Kapchorwa were intimately involved in R7517 and the comments from the five DAOs present at the dissemination workshop, were very positive. This suggests that, for scaling up, the primary engagement with NAADS, would probably be most effective at the district level.

2. Dr Richard Miro, Dept. Education and Extension, Makerere University (MU). He took several copies of our guides and said he would like to use the materials in a training workshop for extension workers in Kabale District. He works with MU Outreach. He said he would like to discuss the production of additional copies with us as the materials are relevant to a number of his activities. Dr Semalulu is following this up. Dr Miro also had some quite specific ideas on how the materials can be incorporated into primary and secondary school education – it has recently been agreed that agriculture should feature more prominently in the curricula. Issues of cost would have to be addressed.

2. Dr James Ndufa (KEFRI, Kenya) asked for copies that he plans to distribute to extension workers in his research area in western Kenya. We have asked for feedback from this piloting exercise, after which the provision of further copies will be discussed

3. Dr Peter Ebanyat (Dept. Agriculture, MU) would like to use these materials as teaching materials at MU. This could lead to significant impact as his department is charged with training extension staff, including those destined to become involved in private sector delivery. In discussions with Dr Moses Tenywa and Dr Ebanyat, Dept. Agriculture, Makerere University and Dr Rob Delve, TSBF/CIAT we have agreed that it would be desirable to try integrate our tools and approaches into a single product.

Currently overlap is minimal with the MU emphasis being on the Lake Victoria Crescent AEZ and the TSBF/CIAT tools being largely decision support tools. This three-way link has the potential to produce some useful high-impact outputs.

4. Dr Semalulu has had recent requests for copies of the materials from a number of colleagues within the Soils Division of NARO and also other divisions, particularly the Banana Breeding Programme and NARO outreach.

6. At the recent NRSP hillsides workshop in Nepal, Dr George Weber and colleagues from the Swiss-funded Sustainable Soil Management Project (SSMP), was very positive about the project work in Uganda – particularly the focus on producing tools for extension. He asked if he could send one or two project members to participate in the R7517 results communication workshop, though due to a clash with dates they did not attend.

The decision, made early in the research, to employ a "resource-light" approach in developing the tools means that wider dissemination and scaling up of the tools produced is quite feasible. The request from NAADS (1 above) represents a very clear route for potential scaling up of the project outputs, within NAADS, across eastern Uganda and nationally, led by NARO.

With the NAADs process and the restructuring of NARO it is not clear how the project model for forming institutional partnerships (output 4) can be best scaled up. R7517 had the services of a RA full time to support the work of four LPs. This was important for the research as high quality feed-back from the field was required and there were frequent activities linked to developing and testing the tools and approaches that would not be required once they were in general use. However, there is no doubt that the presence of researchers in some capacity at district level is desirable as this allows "research" to liaise with and support LPs, providing the backstopping that is currently lacking. If the NARO outreach section survives the current restructuring and if both NAADS and NARO take on board the necessity of back-stopping LPs and keeping the LP-Research lines of communication open then researchers present District Farm Institutes may be able to provide this crucial LP support service. Currently the lack of provision for research capacity and linkages between private sector service providers and research in the NAADS framework is a concern.

5.3.1 Supply of planting materials

Many of the soil management practices have a planting component and if farmers are to experiment with and adopt a practice they will need access to planting material. Early in the project there was a bottle-neck with napier grass supply that gradually resolved itself as the grass became established in the communities and farmers started to sell planting material to their neighbours. Unfortunately this is not likely to happen so easily with cover crop seed or tree saplings. The project made use of the District Farm Institutes (DFIs) to screen and multiply cover crop seed. A supply model could be envisaged where the DFIs continue to do this (as they are in Mbale and Kapchorwa) and the planting material is made available to LPs and farmers through strong links with researchers at DFIs. It is not yet clear how this may work in practice with the NAADS process and the uncertainty around the role of the DFIs and researchers at district level. Supply of planting material remains a key

challenge without which scaling up of many of the potentially more popular soil management options is likely to falter.

Dr Semalulu has a particularly strong interest in cover crops and is coordinating a number of studies screening and multiplying seed for a range of species in different agro-ecozones across the country. A number of species were screened at the Mbale and Kapchorwa District Farming Institutes (DFIs) and seed was made available to farmer led research groups in project villages. This work continues.

6. Conclusions

The approach of this research was novel in that the most important guiding principle when developing tools and approaches for soil management was simplicity. This is reflected in the products, particularly part II of the Resource Guide (Annex E), the field level impact and in the enthusiasm of the responses and suggestions at the Results Reporting workshop. At times this was not an easy principle to adhere to as over the last ten years there has been an explosion in the complexity of our theoretical understanding of biophysical basis for soil related problems and decision making of local people around soil management. In distilling the most important aspects of this understanding into tools and approaches accessible to LPs, there is a risk that important detail is sometimes lost. However, with sound judgment this risk can usually be avoided and the benefits are products of real and immediate value to the end-user.

We believe this research has fulfilled its objectives and made real and useful contributions to local professionals working with soil management in eastern Uganda. Furthermore, the developed tools and approaches are more widely relevant in Uganda and east Africa and the approach, focusing on simplicity, local relevance, strengthening institutional links (farmer-LP-researcher), and the value of supporting farmer experimentation are relevant across all aspects of agricultural service provision.

It is also clear that there is more work to be done in this area, particularly in widening the scope of the tools to include other (non hillsides) agro-ecozones and to more comprehensively cover the full range of crops, land degradation issues, nutrient deficiencies and management options across these agro-ecozones.

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