Farmers’ up-take response to soil fertility management practices in Pallisa District, eastern Uganda

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Abstract

The growing decline of soil fertility in sub-Saharan Africa is reflected declining crop yields per unit area, increasing food insecurity and poverty. The problem is multi-faceted and requires many dimensions to tackle it. This study identified different practices farmers use to maintain soil fertility and changes that these practices have undergone over the last 60 years and, how different extension methods by the National Agricultural Research Organisation are used to disseminate research recommended soil fertility management practices influence their uptake/adoptions by the target beneficiaries. Focus group, individual discussions and with field observations and a survey among participants in the training were methods used for data collection in Pallisa District. Qualitative and quantitative data were analysed using SPSS (16.0) software. Crop rotation, grass strips; rotation of Kraals, land fallow, returning residues to the field were the indigenous practices used. These have undergone changes and becoming less practicable. Use of animal manure and Inorganic fertilisers were the most adopted introduced practices with 72.3 and 7.4% adopters, respectively. Demonstrations using the mother-baby approach (entails a two-stage demonstration of recommended soil fertility improvement practices, field days and workshops for participants) worked better for farmers than use of print materials in promoting uptake of use of soil practices. Major constraints to the application of these practices by the beneficiaries include poor accessibility/scarcity, high labour and monitory costs involved, drought, poor handling and transportation facilities (for animal manure) and low farm-gate prices of farm products. Indigenous methods are being abandoned due to growing land shortage; methods that involve hands-on training are most preferred by farmers; uptake of introduced practices, especially inorganic fertilisers and animal manure is most constrained by low and unstable farm-gate prices, drought, inaccessibility, high monitory and labour costs involved and limited capital aggravated by lack of saving culture and poor prioritisation. Therefore, farmers should adopt integrated soil management approaches, and policies that facilitate application of ISFM should be in place, soil information dissemination should take a more practical approach like in the case of mother-baby. Sensitisation of farmers on the value of sharing soil information and mechanism for reward be put in place.

Introduction

Soil fertility depletion is one of the most important biophysical constraints to food security in sub-Saharan Africa (Kimaru and Jama, 2006; Verchot et al., 2007; CIAT 2001) in Uganda and other African countries (World Bank, 2004; CIAT, 2001). The population increase estimated at the rate of one million per year and expected to reach 35 million by 2015 (UBOS, 2006; 2010) will immensely increase demand for food and fibre. According to IFPRI (2004), soil fertility in Uganda is drastically declining and limiting crop yields.

Soil fertility is caused by continuous cropping, burning of crop residues, overgrazing, soil erosion, leaching and nutrient mining, among others. On average -21, -8 and -43 kg ha⁻¹ year⁻¹ of nitrogen (N), phosphorus (P) and K are lost per year (Wortmann and Kaizzi, 1998; Nkonya et al., 2005).

Low adoption of recommended soil fertility management practices in Pallisa District is responsible for the growing decline in soil fertility. Limited access to extension services and inputs, high input costs, poor attitudes, low farm-gate prices among other factors have been advanced for the failure (NARO/DFiD, 2001). There has been little attention on how dissemination methods used contribute to...
this problem. Therefore this study was instrumental in informing researchers on what adjustments to make on recommendations to smallholder farmers on different soil fertility enhancement practices, extension workers on better options/methodologies to enhance dissemination, subsequent uptake and adoption of appropriate soil technologies. Furthermore, it was to provide a basis for formulation of favourable policies by policy makers.

The objectives of the study were to describe the trend in the soil fertility management practices, different extension methods used by NARO with their influence on adoption of disseminated recommended soil fertility management practices and other factors that influence farmers’ decisions to learn, use and or share soil fertility management information with other farmers in Pallisa district.

Materials and methods

Site description and sampling

This study took a descriptive approach, focusing mainly of qualitative information with limited quantitative data. This was meant to dig out detailed information using a number of methods including observation of things as they are in farmers’ conditions. The scope was limited to the project area. ButoBo and Opwateta sub-Counties with Opwateta, Kapwai, Kadesok and Butebo parishes were selected and purposefully sampled. Farmer groups that participated in the training were purposefully sampled in each parish. Purposeful sampling method was used to identify farmers who participated (both adopters and none adopters) in the training for the focus group discussions. At household levels, observations of practices were made and photographed. A survey was then conducted, with the study population comprising of all those who participated in the dissemination processes. Participating farmers in all the parishes were identified, registered and given numbers. A sample size of 100 farmers was drawn through a simple sampling technique involving a raffle with replacement. Semi-structured interviewer-administered questionnaires were used to capture information. Survey data was analysed using SPSS computer software while qualitative data was analysed by content.

Results

Figure Trend of soil fertility in Opwateta and Kanyum sub counties, Pallisa District

![Figure 1a: Opwateta village, Opwateta Parish](image_url)
Figure 1b: In Kituba village, Kanyum parish,

Table 1: Indigenous soil fertility management practices and their level of usage

<table>
<thead>
<tr>
<th>Practice</th>
<th>Distribution of the practice (%)</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop rotation</td>
<td>100</td>
<td>Growing over reliance by farmers on few crops (especially cereals) for food and income as land become limited with growing human population.</td>
</tr>
<tr>
<td>Grass strips</td>
<td>88</td>
<td>Growing land shortage causing encroachment</td>
</tr>
<tr>
<td>Land fallow</td>
<td>15</td>
<td>Land shortage</td>
</tr>
<tr>
<td>Rotation Kraals on farm land</td>
<td>13</td>
<td>Limited number of cattle due to limited land</td>
</tr>
<tr>
<td>Maintaining crop residues in the field</td>
<td>83</td>
<td>Growing demand from non-farm use like hut thatching and fuel wood</td>
</tr>
</tbody>
</table>

Figure 2: Changes in level of frequencies of crops/practices in rotation sequences and bush fallow over the years

Figure Degraded grass strips used to check soil erosion by runoff

Figure Direct application of crop residues to the gardens
Figure Using cereal stalks as thatching and fuel wood materials

### Table 2: Soil practices disseminated and influence of each dissemination method used on uptake by farmers

<table>
<thead>
<tr>
<th>The method the respondent considered to have best enabled him/her to grasp the skills on soil fertility management</th>
<th>Level of adoption of soil the respondent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of demonstration with field days and workshops (mother-baby approach).</td>
<td>Inorganic fertilisers</td>
</tr>
<tr>
<td></td>
<td>7.4</td>
</tr>
<tr>
<td>Use of brochures</td>
<td>0</td>
</tr>
<tr>
<td>Use of posters</td>
<td>0</td>
</tr>
</tbody>
</table>

### Table 3: Diffusion of disseminated soil practices through farmer to farmer transfer of skills

<table>
<thead>
<tr>
<th>S/n</th>
<th>Number of visiting adopters per host farmer who adopted at least one of the soil practices disseminated</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1-5</td>
<td>69</td>
<td>69</td>
</tr>
<tr>
<td>2</td>
<td>6-10</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>3</td>
<td>11-15</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>16-20</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>None of the visiting farmers adopted a practice</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

### Table 4: Influence of social relations on diffusion of soil practices by mother-baby approach

<table>
<thead>
<tr>
<th>S/n</th>
<th>Relationship of the visiting adopters with host farmer</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Relatives in the village</td>
<td>64</td>
<td>64</td>
</tr>
<tr>
<td>2</td>
<td>Non relative in the village</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>3</td>
<td>Relatives outside the village</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>None relatives outside the village</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>
Figure 7: Variability in household income, food availability and workload as a constraint to adoption

Table 5: Most constraining factors to the use of animal manure

<table>
<thead>
<tr>
<th>Constraint</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited transportation and handling facilities</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Scarcity</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Limited transportation/ handling facilities and scarcity</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>scarcity and bad smell</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>high labor, limited transportation and handling means/facilities</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 6: Major constraints to inorganic fertiliser use experienced by respondents

<table>
<thead>
<tr>
<th>Constraints</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>high fertiliser cost</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>limited access</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>limited access and high cost</td>
<td>82</td>
<td>82</td>
</tr>
<tr>
<td>limited use of knowledge of use of fertiliser</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Discussion
Indigenous soil fertility management practices used in the area
While all the five traditional practices are important to different categories of farmers; the following section will discuss use of grass strips, crop rotation and household crop residues that are used by most (80%) of the respondents in the three sub-counties. Less than 20% used fallowing and kraal rotation.

Discussions with farmers indicate that traditional soil fertility management practices have played a big role in maintaining soil fertility. However, increasing land shortage has affected application of these practices (Table 1). Grass strips, though used by Most (85%) of farmers, have shrunk in size from between 2-3 m wide to less than 0.5 m wide (Figure 3). More than 80% of farmers believe that proper management of crop residues helps maintain soil fertility. This is in line with findings by (FAO, 2001; Horwath, 2005; Sangina and Woomer, 2009) that recognise the value of crop residue in improving soil organic matter (SOM) level. However, maintenance of this vital component of a fertile soil is being affected by the growing level of competitive usage of crop residues as fuel wood and hut thatching materials (Figure 5). This concurs with other studies (IARI, 2012) on constraints to the management of crop residues for soil improvement. Crop rotation is still practiced by 100% of the respondents. However, the recommended practice of alternating shallow rooted crops with deep-rooted crops (UCS, 2008) has been interrupted as cereals become more dominant in the system than any other crop (Figure 2) due to land shortage. The usefulness of indigenous soil management practice has been negatively affected.

Methods used and their impact on uptake of the promoted soil practices in the area
These practices were introduced in the area by NARO through two methods: the Mother - baby training approach through farmer groups and use of print materials (brochures and posters). The ‘mother-baby’ depicts a technology/practice-dissemination approach that uses various strategies to impart soil improvement skills and knowledge to farmers. It entails a two-stage demonstration of recommended soil fertility improvement practices, and holding field days and workshops for participants. Discussion and survey results show that more than 70% of farmers who adopted any of the practices attribute their adoption to mother-baby methodology as compared to print materials (Table 2). Farmers attribute this to the practical nature of the approach (mother-baby) that facilitates hearing, seeing and doing, which make feedback easy, hands-on learning and experience sharing easy. This agrees with Berend (2004) who asserts that it is not the content but the method of delivering the content that makes a successful training. On what combination of extension methods to accelerate dissemination and adoption of soil fertility technologies, most (96%) of respondents preferred combination of extension methods that facilitated hearing, seeing and doing (mother-baby in combination with radio programs and regular contacts with field based trainers). Combination of mother-baby with print material was rated least at 4%. However, of those farmers who attributed their adopting soil technologies, appetite for reading declined with age. While 7.1% of 16-25 year age group found it useful in giving knowledge, 5.2% of age groups 26-45, 3.8% of 46-60 and 0% of and 61+ year categories found brochures useful. Discussions with participants in groups and as individuals attribute this trend to visual impairment and increase in responsibility that come with age. Younger persons are perceived to have better visual strength and less responsibility, thereby having time to read. Adults are perceived to have many responsibilities. Therefore, any extension methods that shorten learning processes are less preferred as one ages. The problem attributed to visual problem agrees with findings by Donia and LaurenScharff (2002) which indicate that human body systems decline in performance with age.

Practices adopted and major constraints
Animal manure was adopted by 72.3% of the farmers while inorganic manure was adopted by 7.4% (Table 2). Main constraints to their use include poor accessibility/scarcity, high labour and monitory costs, drought, poor handling and transportation facilities (for animal manure) and low farm-gate prices (Tables 5 and 6). This agrees with other findings (Kaizzi et al., 2007b; FAO, 2012; Muzari, 2012). Yearly variability in household food and income level (lowest at planting seasons) (Figure 7), poor saving culture and prioritisation for investment in soils also emerged as constraining factors to...
adoption of use of animal manure and inorganic fertilisers. Social relationship also influenced farmers’
decisions to share learnt soil fertility enhancement skills and knowledge with other farmers. While 73% 
of respondents shared learnt skills with relatives, only 27% shared with non relatives. This kind of 
preferential treatment is embedded in a common belief here that at a time of need, none relatives cannot 
help as much as one’s relative does. This affects farmer-to-farmer knowledge diffusion in a 
heterogeneous society if contact farmers are of the same ethnic background. More than 90% of animal 
manure is collected during dry season and applied directly on surface to the field before 
cultivation and after planning.

Conclusions

- Indigenous soil fertility management practices used by farmers in the project area have experienced 
  severe constraints and are collapsing due to land shortage resulting from the growing human 
  population
- Farmers’ uptake response to a soil technology/practice (especially use of animal manure and 
  inorganic fertilisers) is influenced by accessibility/availability, labour and financial costs associated 
  with it, farm-gate prices on which such an input was used, drought, land availability and limited 
  capital/poor saving culture
- Effective dissemination of recommended soil fertility enhancement practices, other factors being 
  constant, requires methods that facilitate seeing, hearing and doing by the target beneficiaries as in 
  the case of mother-baby methodology
- Farmers are willing to share out soil information acquired but mainly with those from whom they 
  see prospect of reciprocation in time need. The social support network is strongly centered on blood 
  relations than any other factor. This in effect dictates on the pattern of sharing resources among 
  farmers. As a result, it is common to find that vital information is shared mainly with those related 
  by birth or marriage

Recommendations

- As indigenous methods of maintaining soil fertility collapse, farmers should embrace an integrated 
  approach to soil fertility management
- Favourable policies that make recommended technologies affordable and accessible by farmers 
  should be put in place by the policy makers
- Farmers should adopt a cooperative approach to marketing and purchasing of farm produce and 
  input to enable them enjoy economies of scale and escape exploitation by middlemen. This will 
  provide them with incentives to invest in soil technologies cheaply
- Dissemination of soil fertility technologies by extension agencies should take on a more practical 
  methodologies that foster learning through combined effects of seeing, hearing and doing as is with 
  mother-baby approach used by NARO. But this should integrate strategies that promote farmer 
  institutional development, attitude and behaviour change of farmers for corporate use of 
  agricultural information for growth
- Research, extension and policy makers should devise mechanisms of providing incentives to farmers 
  to freely share soil information. This will encourage wider coverage of the community through one-
  on-one transfer of knowledge and skills
- This study focused on NARO which played the role of extension in diffusing recommended soil 
  fertility management practices. However, there is need for further research in other parts of the 
  country to explore how other agricultural agencies are effectively communicating soil fertility 
  management practices to farmers

Acknowledgment
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