# ENHANCING COMMUNICATION FOR EFFECTIVE DISSEMINATION OF SOIL FERTILITY MANAGEMENT IN THE CENTRAL HIGHLANDS OF KENYA

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**A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF ENVIRONMENTAL STUDIES (COMMUNITY DEVELOPMENT) IN THE SCHOOL OF ENVIRONMENTAL STUDIES OF KENYATTA UNIVERSITY**

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## DECLARATION

### Candidate's Declaration

This thesis is my original work and has not been presented for a degree in any other university or any other award.

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### Declaration by Supervisors

I/We confirm that the work reported in this thesis was carried out by the candidate under my /our supervision

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## DEDICATION

This thesis is dedicated to my loving husband, Mr. Benson Muchai and our two daughters, Vivian Wanjiru and Asher Wanjiku. Thank you for all you have sacrificed to make this degree a reality. God has truly blessed us.

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## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| a.s.l | Above Sea Level |
| CBO | Community Based Organization |
| FFS | Farmer Field School |
| FGDs | Focus Group Discussions |
| FYM | Farm Yard Manure |
| INMASP | Integrated Nutrient Management to Attain Sustainable Productivity |
| ISFM | Integrated Soil Fertility Management technologies |
| MB | Mother Baby |
| NARS | National Agricultural Research Systems |
| NGO | Non Government Organization |
| R&D | Research and Development |
| SFM | Soil Fertility Management |
| SPSS | Statistical Package for Social Sciences |
| SSA | Sub-Saharan Africa |
| ESPs | Extension Service Providers |

# ABSTRACT

Increased recognition of soil fertility depletion as the main biophysical factor limiting crop production in many African small holder farms has renewed interest in the dissemination of soil fertility management (SFM) practices. Despite soil technology development and research outputs, few of the recommendations from soil fertility management research have been put into use by the targeted end users. Accessibility and utilization of the existing knowledge is inadequate due to the communication methods and tools used in dissemination and up scaling of soil fertility management practices. With this background, this study was set out with the following objectives; i) to investigate availability and reliability of sources on SFM for farmers, ii) to identify communication channels used by researchers and extension agents and iii) to determine socio- economic factors that influence preference of communication methods by farmers, in the Central highlands of Kenya. Questionnaires were used to collect information from 22 researchers and 105 extension workers. In order to determine the socio-economic factors influencing farmers' preferences of communication methods, individual household interviews were conducted where 240 randomly selected farmers were interviewed. Data was analyzed using descriptive statistics (frequency, mean, percentages and Chi-square). Spearman correlation coefficient and logistic regressions were used to test the magnitude of the relationship between dependent and independent variables using statistical package for social sciences (SPSS) programme. Results showed that farmers perceived other farmers as the most available and reliable source of information on SFM while radio were perceived as highly available but relatively unreliable by farmers. Demonstration, farmer to farmer extension and workshops/seminar were sequentially ranked as the first three methods preferred by the farmers. Majority of the researchers and extension officers frequently used field days and demonstration as methods of communicating to farmers on soil fertility management. Preference of demonstration by farmers in training on green manure was positively influenced by age ($r=0.158$, $P=0.05$) and number of non formal trainings ($r=0.114$, $P=0.05$) but negatively influenced by farm size ($r=-0.132$, $P=0.05$) and gender ($r=-0.184$, $P=0.01$). Gender, education, number of non formal trainings attended, farm size and number of times a farmer had been visited by an extension agent were significant predictors in preference of field days in training on animal manure. Continued use of demonstration method was recommended as it was highly preferred by the farmers as well as considered effective by the extension agents and researchers. For effective dissemination of SFM, agricultural stakeholders should consider farmers' socio-economic characteristics while designing extension intervention strategies to be used in dissemination of soil fertility management practices. This is envisaged to increase adoption of SFM practices which will consequently lead to increased crop production and contribute to reduction of extreme poverty.

# CHAPTER ONE

## 1.0 INTRODUCTION

### 1.1. Background of the study

Soil fertility depletion in small holder farms is the fundamental biophysical root cause of declining per capital food production in Africa (Sanchez et al., 1997). Food deficits in many parts of sub-Saharan Africa can be offset through reversing the current trends of declining soil fertility and agricultural productivity (Onduru et al., 2002). For example, in central Kenya, increase in maize yield with application of tithonia, calliandra and leucaena biomass has been reported (Mugendi et al., 1999), while in another study combination of organic materials and inorganic fertilizers has been shown to result to higher maize yields as compared to the use of inorganic fertilizer alone (Mugwe et al., 2009). Ironically, a large number of initiatives, by both national and international research and development institutions and partners, aimed at addressing soil fertility challenges in smallholder farming systems have failed to generate the desired impacts at scale (Ashby, 2003). Despite the evidence suggesting positive returns to labour, land and time investments into these technologies (Mekuria and Siziba, 2003), which are predominantly derived from plot-level data, the adoption of these technologies remains low.

One of the problems facing past and current research and development (R&D) in natural resources management (NRM) is failure to effectively communicate findings to stakeholders other than farmers (Garforth, 1998; Ashby, 2003). There is emerging evidence for lack of suitable mechanisms for transferring the available knowledge on

concepts and principles of SFM technologies to extension agencies, farmers and other agricultural service providers, in ways that promote innovation and sustainable adoption (Mekuria and Waddington, 2002; Mapfumo, 2009). The key problem faced by governments and donors is how to improve the interchange of information between the farmer, the researcher, and the extension agent (Commonwealth secretariat, 2001).

In attempts to solve the problems of soil fertility degradation and food insecurity, various participatory methods have been used in scaling up research findings in different projects. In Africa, farmer field schools (FFS) are currently running in many countries such as Burkina Faso, Kenya, Mali, Zambia, Zimbabwe, Uganda, Sudan, Malawi, Ghana, and Tanzania with support from a large number of organizations (FAO, 2000; Khisa, 2000; Abate, 2001; Kaaria, 2001; Onduru et al., 2002). Different research institutions in Kenya have successfully used Mother-Baby trials in different research topics ranging from plant breeding to integrated soil fertility management (ISFM) technologies (Misiko and Ramisch, 2007; Mureithi et al., 2007; Mugwe et al., 2009). Numerous successes have been reported in projects that have worked with farmer groups (Noordin et al., 2003; Sanginga et al., 2005; Mugwe and Kung'u, 2006; Kiptot, 2007; Misiko and Ramisch, 2007; Mugwe et al., 2009), and can be recommended as best approach for scaling up soil fertility technologies compared to working with individual farmers. Village training workshop as method was used in a collaborative project between Kenyatta University and Ministry of Agriculture in Meru South and Mbeere districts, central Kenya (funded by FARM AFRICA), to disseminate soil fertility management technologies (Mucheru-Muna et al., 2005).

Experience has shown that extension service providers (ESPs) often apply a single approach and set of methods, whether or not such approaches and methods are appropriate and effective in different circumstances. Some of the approaches used by ESPs encourage dependency through provision of "handouts" to clients (NASEP, 2007). This often results into low adoption of technologies and hence little or no impact of the resources put into extension (NASEP, 2007). Consequently, there is need to establish extension approaches that should focus among others, aspects on clients' socio-economic status for effective communication of soil fertility management practices. This study therefore endeavored to find out the communication methodologies and approaches that are effective on promotion and scaling up knowledge on soil fertility management technologies.

### 1.2. Statement of the Problem

The ultimate purpose of agricultural research is to increase agricultural production and incomes through technologies and information. This can only be achieved if the technology and information generated by the agricultural research system is widely applied and adopted at farm level. Unfortunately, despite the many technologies developed on station and tested on farm by the National Agricultural Research System (NARS) in Kenya, wide scale adoption at farm level remains low and the productivity continues to be low. Lack of access to reliable and current information coupled with wide communication gaps between researchers and farmers are presently a major impediment to adoption of SFM by farmers in the region (Odendo et al., 2006; Rege, 2006; Damisa and Igonoh, 2007; Sanginga and Woomer, 2009). Consequently, SFM knowledge has not

been optimally utilised to address soil fertility management problems. Poor communication as a result of uncoordinated channels of information delivery to farmers has been a major deterrence to information flow between researchers and farmers (Rees et al., 2000). There is a scarcity of literature on availability and reliability of information sources on SFM, the extension methods preferred by farmers for receiving SFM information, and the socio-economic aspects affecting preference of the extension methods. In view of this, the study was carried out to assess the availability and reliability of information sources on SFM by farmers. It also aimed at finding out the communication methods that are effective and preferred by farmers in dissemination soil fertility management technologies.

### 1.3. Research Questions

The study sought to answer the following questions:

i. Which are the available and reliable sources of information for farmers on soil fertility management?
ii. Which communication methods are used by researchers and other agricultural stakeholders in dissemination and up scaling of soil fertility management practices?
iii. What are the effects of socio-economic factors on farmers' preference of communication methods and tools used to disseminate soil fertility management practices?

### 1.4 Objectives

The general objective of the study was to investigate communication channels used in dissemination of soil fertility management (SFM) practices in the Central highlands of

Kenya. To achieve this objective the study sought to address the following specific objectives;

i. To assess the availability and reliability of information sources utilized by farmers to improve soil fertility on their farms.
ii. To establish the communication methods and tools used by researchers and other agricultural stakeholders in dissemination and up scaling of soil fertility management practices.
iii. To determine the effect of socio-economic characteristics on farmers' preference of communication methods used in dissemination of soil fertility management practices.

### 1.5 Hypotheses

The study tested the following hypothesis

i. Government extension agents and farmers are the most available and reliable sources of information for farmers on soil fertility management practices.
ii. Of the various communication methods used by researchers and other agricultural stakeholders in dissemination of soil fertility management practices, field days and demonstrations are the most commonly used.
iii. Socio-economic factors positively influence farmers' preference of communication methods and tools used to disseminate soil fertility management practices.

### 1.6. Significance of the study

The information generated from this study provides recommendation for improving communication approaches in order to benefit the end-users. Researchers and extension

agents will be able to choose appropriate tools and methods for communication of information for various soil fertility management options, thus accelerate the up scaling and adoption of soil fertility management research outputs. Increased adoption of soil fertility management technologies will lead to increased crop production and contribute to reduction of poverty.

### 1.7. Conceptual framework

The effectiveness of up scaling soil fertility management technologies hinges upon the efficacy of communication and tools used in dissemination of research findings. To ensure impact of communication: effective methods, media and information sources are very important in diffusion of innovation (Melcot, 1998). According to the framework (Figure 1.1), knowledge on soil fertility management technologies is generated in established formal institutions and made available for key development actors and extension workers (Arrow 1) as well as to the farmers (Arrow 2). Those inherently superior technologies and practices are adopted by extension and development agencies who then transfer the technology using different communication channels to the farmers (Arrow 3).

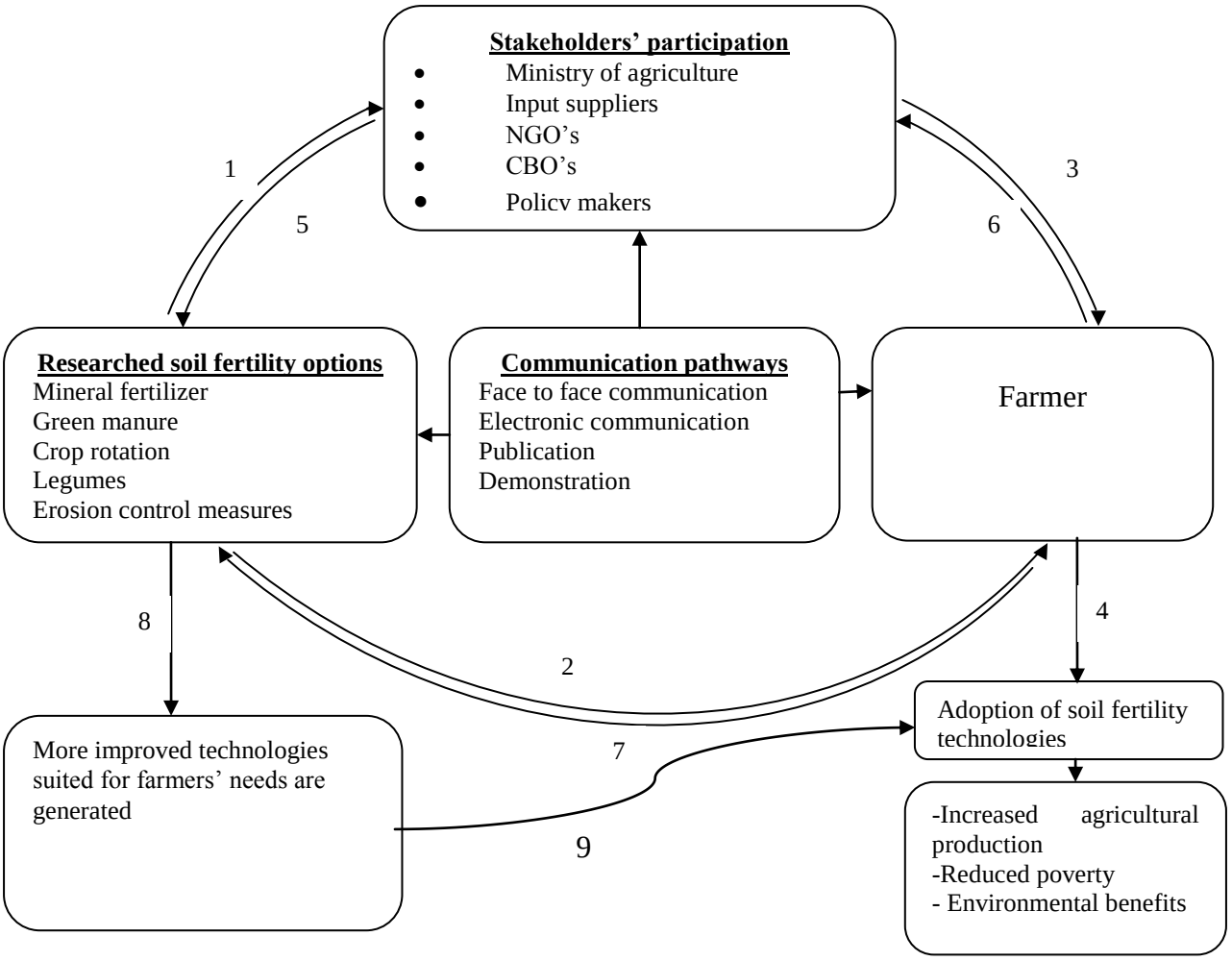



**Figure 1.1:** Conceptual framework showing communication pathways for up scaling of soil fertility management

Finally, arrow 4 indicates the automatic adoption of the new practice by farmer eagerly awaiting solutions that address the key constraints in their evolving food systems. However, according to Rogers (1995) the technology is passed from its source to the end users through medium (e.g. news media, opinion leaders, on-farm or on- station demonstrations, field days) but its diffusion to potential users is dependent to a great extent on the personal attributes of the individual user. The backward arrows (5, 6 and 7) represent feedback mechanisms from the extension agents and the farmers. Once the

researchers receive feedback from the extension agents and the farmers, (Arrow 8) they modify the technologies to suit the local conditions and offer social, economic and technological solutions. The modified technologies will eventually be adopted by the farmers (Arrow 9). The conceptual diagram shows that effective communication pathways will enhance utilization of improved soil fertility technologies that will lead to increased agricultural production, improve the livelihoods of the poor and increase environmental benefits. The purpose of the study was to come up with the most reliable and effective communication channels through understanding information exchange pathways and processes among key stakeholders depicted in the conceptual framework.

### 1.8. Definitions of terms

**Communication-**The process of passing information from source to recipient with the intention of getting a feedback from the recipient

**Communication Channels –** These are the tools and human beings used to pass information from source to recipient

**Communication strategy -** In the context of this study, these concerns preparing the ground, for communication and dialogue, which will enable effective scaling-up of the research products after a project is over

**Dissemination -** The act of distributing information to various audiences in forms appropriate to their needs. Dissemination aims to increase the wider awareness of research products and, in turn, to enhance the speed of uptake

**Effectiveness** - explains producing the result that is wanted, or intended for a successful result. In this study, effectiveness is conceived as the ability of the farmers to acquire the necessary knowledge, skills and attitudes on soil fertility technologies that will allow them to utilize information and technology effectively with the ultimate aim of improving soil fertility

**Pathways -** The route or channel through which research products reach the users

**Preference** -Make a suitable or a desirable choice when provided with different options

**Research products -** Findings and results of research e.g., methodologies; decision-making tools; process recommendations; scientific understanding; technical information; transferable technologies; sets of alternatives from which end-users choose

**Scaling-up -** Scaling-up aims to provide more quality benefits to more people over a wider geographical area more quickly, more equitably and more lastingly' (IIRR, 2000)

**Stakeholders -** Those persons and organizations that should benefit from, or at least engage with, a project (on SFM research) either directly through their involvement in the research or indirectly through the communication and scaling-up of research products

**Target groups and end-users -** Individuals, households, communities, associations, etc., that are engaged farming

**Extension approaches -** Style of managing an extension system, e.g. conventional extension, training and visit, participatory extension, integrated project approach, farming systems approach to research, extension and training, multi-disciplinary pastoralist approach, cost sharing and educational institution approach

**Extension method**- A systematic way or technique of transferring knowledge and technology or communicating and exchanging information

# CHAPTER TWO

# 2.0 LITERATURE REVIEW

## 2.1 Overview

Declining soil fertility is a major cause of low per capital food production on small holder farms of sub-Saharan Africa. In order to address this challenge, studies in the central highlands of Kenya and other areas in sub-Saharan Africa have identified soil fertility management interventions that would help the poor resource farmers mitigate problems of food insecurity and improve resilience of the soils productive capacity (Bationo et al., 2003). However, past research in Kenya shows that adoption of new agricultural technologies, including soil management practices among the smallholder farmers has generally lagged behind scientific and technological advances, and hence their impact on agricultural production has been low (Okuro et al., 2002). It has been observed that the channels through which the technologies are being communicated to farmers are grossly inefficient and thus lead to the ineffectiveness in the adoption of the recent agricultural technologies (Ahmed-Akinola, 2004). The section below focuses on a review of literature pertaining to interventions on soil fertility management, information exchange pathways, and social-economic factors that affect farmers' preference of communication channels.

## 2.2 Soil Fertility Management Practices

Soil fertility replenishment in sub Saharan Africa (SSA) is critical to the process of poverty alleviation (Place et al., 2003). Recent studies have indicated that, use of well managed nutrient replenishment regimes incorporating use of manure and modest amounts of fertilizers are important to increased and sustained crop yields (Kimani et al.,

1998). After 4 years of continuous cultivation and manuring, cattle manure proved to be the most effective and improved soil fertility by increasing soil pH, cations (Ca, K and Mg), and C (Mugwe et al., 2009). Sole application of calliandra, leucaena and tithonia biomass has been associated with increased maize yields more than the recommended inorganic fertilizer (60kg N/ha) (Mugwe et al., 2009). Experiments under observation for seven consecutive seasons, in central Kenya, showed that staggered maize-legume intercrop (Mbili) caused an increase in crop yields and led to more economic benefits (Mucheru-Muna et al., 2010). In another study in central Kenya, Kimani et al. (1998) reported a maize yield of 4.82 t $ha^{-1}$ by applying 80 kg N $ha^{-1}$ as FYM compared to a yield of 2.53 t $ha^{-1}$ for the control treatment. In the same study, yields were higher at 6.5 t $ha^{-1}$ when manure was combined with 40 kg N $ha^{-1}$ of mineral fertilizer. According to Mugwe et al. (2009) a sound nutrient management system should strive to make a balance between maximizing crop production and sustaining soil quality. Farmers increasingly need information about soil fertility management technology supposedly designed to benefit them. However, it is important that this information is made available in an appropriate format and language and that farmers have the capacity to analyze it and act on it.

### 2.3 Sources of information on soil fertility management

Sourcing and effective dissemination of information is a highly recognized factor which aids adoption of improved farm practices (Oladoja, 2008**).** Rogers (1995) defines the message source as an individual or institution that originates with the message and explained that the message source can be different in each country. According to FAO (2000), rural communities need a wide variety of information. The content of the

information services needs to reflect their diverse circumstances and livelihoods. Maddox et al. (2003) reported that in North Carolina (NC) sources of information included, other farmers, NC Department of Agriculture extension agents, NC Cooperatives extension gents, magazine articles, family, friends, and neighbors, organizational newsletters bulletins, fact sheets, on-farm visits and meetings. Moreover, Roger (1995) observed that source of information such as neighbors and friends played an important role in technology adoption in addition to formal extension services.

Farmer's access to different information sources helps them to get information about improved technologies and enhance the adoption of new innovations. Conducting various extension events plays an important role in the provision of different agricultural information and consequently enhances the utilization of the accessed information (Pipy, 2006). Different sources of information are important as they make the farmer aware of alternatives from where they can choose the most desirable soil fertility technology suited to their needs. The change agents, researchers, extension workers and policy makers need to identify those sources of information that farmers use most as this will help in appraising effective communication pathways in dissemination of soil fertility management practices. This study therefore endeavored to asses the availability and reliability of information sources as perceived by the farmers.

### 2.4 Extension methods used in dissemination of soil fertility management

An effective extension communication is a necessity for extension service to achieve its broad goal of farmers acquiring knowledge, skill and attitude and in the overall, better their economic strength and hence their standard of living (Okunade, 2007). Extension

workers use variety of extension methods to disseminate information regarding soil fertility management practices. According to Farouque and Takeya (2009), the more practical methods are in presenting a topic, the more quickly people will tend to grasp the subject matter. Garforth (1993) classified extension teaching methods into three broad classes in terms of area of coverage as follows (1) Individual contact methods, 2) Group methods (3) Mass media methods. Individual contact methods are superior for conviction and action because of face to face relationship of a source and a receiver (Okunade, 2007). The individual contact methods include farm and home visits, office calls and telephone calls. Group methods include demonstration, exchange visits, farmer field schools (FFS), field days, workshops and exhibitions. Mass media methods are methods to reach many people at the same time for example electronic media such as radio, television, internet and print media like brochure, newsletters, manuals, books and magazines.

Rogers (1995) explained that the most commonly used channels of communication include mass media (radio and television), print media (pamphlets, brochures, labels and magazines) and inter-personal media (seminars, demonstrations, field days exchange visits and agricultural shows). According to Sim and Hilmi (1987), field days, tours and demonstration are some of the methods that have been used by research and extension agents. According to FAO (1986) greater implementation of SFM requires appropriate selection of extension methods that can address farmers' needs. Extension approaches and methods should be appropriate to the situation in which they are used, taking account of the socio-economic status of the clientele, the cultural environment, agro-ecological

conditions, market demand and the technical requirements of enterprises covered by the extension service (NASEP, 2007).

Studies on dissemination approaches which are preferred by farmers in the SSA and especially in central Kenya in relation to SFM are rare, yet this information is crucial to enable more efficient SFM scaling-up. This study therefore endeavored to find out the communication methodologies and approaches that are preferred by farmers in promotion and scaling up knowledge on soil fertility management technologies.

### 2.5 Role of extension agents in dissemination of soil fertility management practices

Extension agents are professionals in the extension system responsible for enhancing farmers' acceptance of innovative practices from research which leads to increased farmers' productivity and income. The agricultural extension service has been in the forefront in educating farmers about new technology and providing technical assistance (Anderson, 2008). Extension system acts as liaison between the researcher and farmer. They are endowed with the responsibility of conveying research findings from the scientists to the farmers and feeding back the impressions of the farmers to the scientists. Salawu and Abubakar (2008) emphasized that extension agents must provide help to the agriculture community to encourage them to take the right actions, to solve their problems and to help them in finding a solution. The success of dissemination of soil fertility management technologies will largely depend on the teaching methods used by extension agents in conveying information to the farmers. According to Ogunwale (1991) effective extension agents must not only rely on variety of extension teaching methods to do their job well, they must also know where and how to use them. Overall, public

extension services have consistently failed to deal with the site-specific needs, characteristics and problems of the farmers (Ahmad et al., 2000). Given all the training and skills that extension agents possess, the approach and methods of interaction with farmers is critical in the evolvement of the rapport that develops between extension agents and farmers (Röling andVan de Fliert, 1994). It was thus considered essential to assess the extension system in dissemination of soil fertility management practices in the central highlands of Kenya.

### 2.6 Communication Strategy and Knowledge Sharing

Communication is the process of sharing or conveying information by which ideas are transferred from a source to a receiver with the intent to change his or her knowledge, attitude and skill (Adebayo, 1997). The development of tools for communication between scientists and farmers has continued to remain a challenge (Van Dusseldorp, 1992). Research results have been, for quite some time been presented in technical jargons beyond the reach of many farmers in rural communities (Hatibu et al., 2002). The sources and conveyors of information, the way new messages are packaged (especially if they are coached in familiar terms) and targeted can all make a big difference in how the policy document is perceived and utilized (Williamson, 1996). Continuous interaction leads to greater chances of successful communication, the more the time researchers and stakeholders spend with farmers the better the understanding and sharing of information and confidence to confide in each other as partners in technology development and transfer.

The Agricultural sector development strategy (URT, 2001) and the Agricultural sector Development Programme and the medium term plan (MTP) for research and development programme in Tanzania identified poor communication of research results as one of the major problems in the uptake and utilization of research results (MAFS, 2003). According to Norrish (2001) when communication strategy is planned in the beginning of the programme/project, it gives a right direction to target appropriate sharing of products and pathways to share the knowledge obtained from the research. This research study therefore, sought to find out the preferred communication methods by farmers that may be integrated into extension programmes to increase the impact of soil fertility management research outputs.

### 2.7 Participation of stakeholders in dissemination of research outputs

For scaling up to be feasible, research teams must develop and implement sound communication strategies as an integral part of the research process (Garforth, 1998). This will ensure that new knowledge is available for users (development practioners, planners, farmers etc.) in forms that they can utilize and adapt. A common failing is that research projects only considered uptake at the end of their lifetimes, with the development of traditional dissemination materials (such as papers in academic journals and workshops) and little engagement with stakeholders (Gundel et al., 2002). Projects tended to focus on geographical and quantitative (i.e., horizontal) dimensions of scaling up and neglected institution processes (i.e., vertical scaling-up). Gundel et al. (2002) emphasized that these pathways are synergistic and overlapping, and need to be linked in order to achieve sustainable impact. According to Norrish (2001) the impact of media

products (such as leaflets, manuals, videos, and web sites, etc.) in research projects is low. This is associated with poor involvement of intended users, a lack of understanding about their communication context, and insufficient appreciation of the real costs involved in producing and distributing appropriate materials.

Rees et al. (2004), identified a considerable number of agencies involved in the production and sharing of information and concluded that some co-ordination of packaging and dissemination of research outputs is necessary just as much as most research services should be based on farmer-demand, the production of information materials on particular technologies and the media in which they are produced, should also be based on farmer demand to the extent possible. Brummett et al. (2004) discuss the main challenges of research outputs based on experiences from linking project where existing research reports were translated into extension materials that could easily be used by intermediary organizations and final end users. The majority of research organizations involves stakeholders, both intermediary and end users, in research priority to some extent. However, there is room to improve stakeholder involvement in dissemination of research outputs to enhance adoption of soil fertility management practices by the farmers

## 2.8 Social Economic Factors that affect farmers' preference on communication methods

The current trend in agricultural communication in developing countries is towards emphasizing the message and the social dynamics of its transmission (Onasanya et al., 2006). Farmer's preference towards communication pathways and channels can be influenced by many factors including their socio -economic characteristics. According to

Nkonya et al. (1997), literate farmers are more disposed to understand new ideas and concepts provided by extension workers and other informants. Exposure to education will increase the farmers' ability to obtain, process and use information relevant to the adoption of soil fertility management technologies. Older farmers often have authority or decision making autonomy thus giving them advantage when it comes to adopting technologies. However, due to changes in the times, younger farmers also have access to education and exposure thus making them receptive to change.

Farmers belonging to a local organization have a higher chance of accessing information on soil fertility management (Katungi, 2006). Social organizations provide a forum for exchange of ideas. Moreover, groups are effective in persuading farmers to try new technologies and it encourages sharing of knowledge and experiences among members. The modes of passing information on soil fertility management have a bearing on the members of the community that have to access the technologies (Katungi, 2006). If they are passed on by sale, poorer members of the community may not have effective access (Sinja et al., 2004). According to a study by Rees et al. (2004), poor farmers had low access to government, non-governmental extension workers and agri-business sources as well as print media. Men had higher a preference to radio and extension than women, suggesting unequal access to these media between men and women (Rees et al., 2004). It is important to state that, farmers particularly differ on their social psychological, economic and communication characteristics and behaviour which should be taken into account while planning and implementing agricultural programmes (Taley and Khadase, 2006). The effect of socio economic characteristics on preference of communication

methods in dissemination of soil fertility management practices. is not known in central Kenya because limited studies have been carried out. As such, the study endeavored to find out how social-economic factors that influence farmers' preference of communication tools and methods used to disseminate soil fertility management technologies.

# CHAPTER THREE

# 3.0 RESEARCH METHODOLOGY

## 3.1 Study Area

The research was carried out in four districts Maara, Meru South, Mbeere South and Embu in the Central highlands of Kenya (Figure 3.1). The choice of the study area was based on the fact that several research projects on soil fertility management practices had been conducted in the region.

Maara and Meru South districts lies in the Upper Midland Agro-ecological Zone (UM2-UM3) (Jaetzold et al., 2006) on the eastern slopes of Mount Kenya at an altitude of 1500 m a.s.l. with annual mean temperature of 20$^{o}$C and total annual rainfall ranging from 1200 to 1400 mm. The rainfall is bimodal with long rains (LR) from March to June and short rains (SR) from October to December. The soils are mainly humic Nitisols (Jaetzold et al., 2006) which are deep, well weathered with moderate to high inherent fertility but this has declined over time with poor management. The 2009 Population and Housing Census recorded 62,177 males and 65,930 females (128,107 persons) in Meru South and 53,387males and 53,738 females (107,125 persons) in Maara (GOK, 2010). According to the Participatory Poverty Assessment reports, 72 % of the population in the two districts is considered to be in the poverty bracket (Jaetzold et al., 2006). These are found all over the districts although a great portion is drawn from the marginal zones comprising of Igambang'ombe and Magumoni Divisions and the lower parts of Chuka, Muthambi and Mwimbi Divisions. The major cash crops are tea and coffee. Maize and beans are the most important and dominant annual crops in the two districts.

Embu lies at the transition between the lower highlands (LH1) and upper midlands (UM1) at an altitude of approximately 1480 m a.s.l. with average monthly maximum temperature of 25$^{o}$C and the minimum is 14$^{o}$C. Total average annual rainfall ranges from 1200 to 1500 mm and the soils are humic Nitisols derived from basic volcanic rocks (Jaetzold et al., 2006). The population densities in Embu District are relatively high, having 725 persons/km$^{2}$ in 2009 (GOK, 2010). The densities are high but are almost evenly distributed in the rural settlement. The available agricultural land per household was 0.82 ha per household of 4.44 persons in 1979 compared to the 1999 figure of 0.6 ha for an equivalent number of persons per household, i.e. 4.40 persons(Jaetzold et al., 2006). It has been reported that 56 per cent of the population in Embu District is absolutely poor while 43.5 per cent of this was categorized as chronically poor. The productive area of Embu district is comparatively small, probably about 40% of the total area. The agricultural potential is approximately 32,100 ha spread over a range of agro-ecological zones (Jaetzold et al., 2006). The main food crops comprise maize, beans, yams, cassava and arrow roots. Pure and improved crosses of dairy cattle, mainly put under zero grazing, dominate livestock keeping enterprises.

Mbeere South lies at the transition between the marginal cotton (LM4) and the main cotton (LM3) agro-ecological Zones (Jaetzold et al., 2006) at an altitude of approximately 800 m a.s.l. with an annual mean temperature ranging from 21.7 to 22.5$^{o}$C and average annual rainfall ranging from 700 to 900 mm. The rainfall is bimodal with long rains (LR) from mid March to June and short rains (SR) from late October to December hence two

cropping seasons per year. The soils are predominantly Ferralsols and Acrisols (Jaetzold et al., 2006). The 2009 National Population Census report shows that the divisions, which form Mbeere District, had a population of 219,220 in 51,545 households with a density of 105 persons/km$^2$ (GOK, 2010). The average farm size per family is less than 5.0 ha. Besides maize and beans, majority of the farmers have attempted to grow sorghum, millet, green grams and cowpeas which are well suited to the climatic conditions in this Subzone.

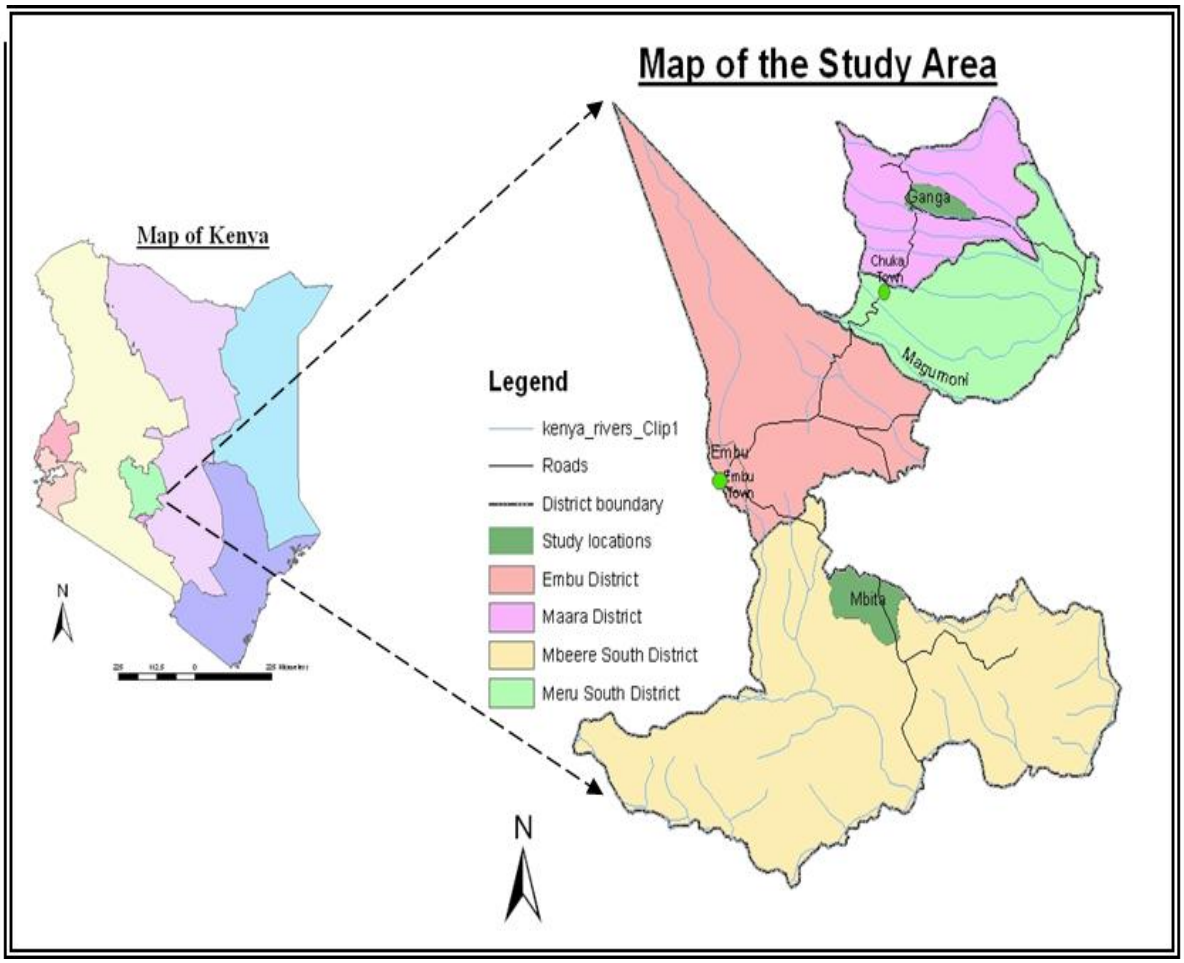



Figure 3.1: Map of the study area showing the locations of Embu, Mbeere South, Meru South and Maara districts of central Kenya

### 3.2 Research Design

A triangulation approach (O'Donoghue and Punch, 2003), was adopted as it enabled an in-depth investigation into the subjects under study. This involved a cross-sectional survey and participatory research that collected data from farmers, extension agents and researchers. Information collected from the farmers, extension workers and researchers was on communication channels applied in dissemination of soil fertility management practices. Both primary and secondary sources of data were used.

### 3.3 Sampling Strategy

The target population was made of researchers, extension workers and farmers. Several sampling procedures were used to select the required respondents. Purposive sampling and snow balling was used to select researchers from different institutions involved in soil fertility management in Mbeere South, Embu, Maara and Meru South districts. A total of 22 respondents were selected and interviewed. Due to the diverse responsibilities of extension workers within the districts, total sampling of extension agents was applied. In total, 105 extension workers from four districts (Mbeere South, Embu, Meru South and Maara) were interviewed.

For the purpose of household interviews, Maara and Mbeere district were randomly selected from the four districts (Mbeere South, Embu, Meru South and Maara) in the central highlands of Kenya. From the two districts, Ganga location in Maara district and Mbita location in Mbeere South district where most of the research on soil fertility management was conducted were purposively selected for the study. The researcher then obtained the list of the households from the chiefs of the selected locations. In Ganga, the

household were 4508 while in Mbita the households were 2536 (Table 3.1). The following formula was used to estimate the required sample size for the household interviews;

$$n = \frac{1.96^2\pi(1-\pi)}{c^2} = \frac{1.96^2 0.5(1-0.5)}{0.09^2} = 120$$

Where: 1.96 is the z-value for a 2-sided 95% confidence interval,

c=0.103 is the desired maximal half-width of the confidence interval, and π=0.5 is the population proportion that results in the widest confidence interval for a given sample size (worst-case for a conservative estimate of sample size).

*n*=number n required to estimate population proportions π with 95% (Wonnacott and Wonnacott, 1977).

A sample size of 116 was obtained from Ganga while in Mbita a sample size of 113 was obtained (Table 3.1). However, it was decided to sample 120 households per district. Systematic random sampling technique was used to select the farmers from each location. A sampling interval of 37 and 21 was used in Ganga and Mbita locations, respectively (Table 3.1). Two hundred and forty (240) respondents were selected for the household interviews.

**Table 3.1**: Sampling of farmers for the purpose of household interviews in Mbeere South and Maara districts

| **Ganga Location** | | **Mbita Location** | |
|---|---|---|---|
| Sampling frame | 4508 | Sampling frame | 2536 |
| Confidence level | 95% | Confidence level | 95% |
| Confidence interval | 9 | Confidence interval | 9 |
| Sampling interval | 37 | Sampling interval | 21 |
| Sample size | 116 | Sample size | 113 |

### 3.4. Data collection

Secondary data were obtained through review of relevant literature from libraries and internet including resource materials such as journals, annual reports, books, workshop proceedings, periodicals and district reports. Primary data was obtained by use of various qualitative and quantitative methods. Farmer interview schedule using a combination of open-ended and closed-ended questions (Appendix 1), the latter serving to elicit response while the former serving as a tool for getting deeper insight into the situation on the ground. Data collected from the farmers include farmers' demographic and socio-economic characteristics, sources of information on SFM practices and communication methods and tools preferred by farmers.

Questionnaires (Appendix 2 and Appendix 3) were used to collect data from the researchers and the extension workers, respectively. Data collected from the extension workers included, soil fertility management practices trained and communication channels used by extension workers. Some information collected from the researchers include, soil fertility management practices researched and communication methods and tools used by researchers in dissemination of their research findings**.**

#### 3.4.1. Pre –testing the research instruments

A pilot study was conducted to test the suitability of the farmers' interview schedule and the questionnaires for both the researchers and extension agents. A sample of 12 farmers from Mbita and Ganga locations were randomly selected and interviewed. Two agricultural extension officers from the four districts (Mbeere South, Embu, Meru South

and Maara) and one researcher participated in the pre-test exercise. Those respondents who participated in the pre-test exercise were excluded in the actual survey.

### 3.5. Data Management and analysis

The first stage of data handling involved data cleaning. The questionnaires were examined to ensure they were complete and had been consistently filled in. All the data was computed using appropriate statistical tools and soft wares to fulfil the objectives of the study. Data collected was first summarised and a data base template containing the collected information was made using Statistical Package for Social Sciences (SPSS) computer software. Descriptive statistics such frequencies, mean, standard deviation and cross tabulations were used to display the data.

The degree of association or correlation (r) between continuous independent variables and dependent variable was measured by the use of Karl Pearson's coefficient while spearman correlation was used between discrete independent variables and dependent variables. Logistic regression model was used to determine socio- economic factors that influence the preference of field days in training on animal manure. The model was specified as follows;

Dependent variable Y=Ln=Ln (P/1-P)

$\text{Ln } (P/1-P) = a+b_1x_1+b_2x_2+\ldots\ldots + b_8 x_8 + e \ldots 1$

Where

Y= preference level of field days to communicate on animal manure (1=Do not prefer, 2=Prefer)

a= y intercept

b= régression coefficients

e= error term

$X_1$-$X_8$= independent variables (……)

**Independent variables were the social–economic characteristics as follows;**

$X_1$ Gender(HH) -1=Male, 2=Female

$X_2$ Age (HH) -Continuous variable

$X_3$ Non formal training- 1=None, 2=1-5 times, 3=6-10 times, 4=More than 10 times

$X_4$ Attitude towards Extension agents 1=favourable, 2=Neutral, 3=unfavourable

$X_5$ Education level (HH) 1=None, 2=Primary, 3=Secondary, 4=Tertiary

$X_6$ Membership of groups -Continuous

$X_7$ Farm size - Continuous variable

$X_8$ Number of times visited by an agricultural officer- Continuous Variable

# CHAPTER FOUR

# 4.0 RESULTS AND DISCUSSIONS

## 4.1 Farmers' socio-economic characteristics

### 4.1.1 Gender, age and education level of the respondents

Majority of the households interviewed were male headed (72.1%), while female headed households comprised of 27.9% (Table 4.1). There was a significant relationship ($\chi^2$=22.55, P=0.001) between gender and district, with a higher percentage (74.6%) of the female farmers in Mbeere South than in Maara (25.4%) district.

**Table 4.1:** Gender of household heads of respondents in Mbeere South and Maara districts in Central Kenya

| Gender | Maara | Mbeere South | Total | Chi square($\chi^2$) | P value |
|---|---|---|---|---|---|
| Male | 103 (85.8) | 70 (58.3) | 173 (72.1) | 22.549 | 0.0001 |
| Female | 17 (14.2) | 50 (41.7) | 67 (27.9) | | |
| Total | 120 (100) | 120 (100) | 240 (100) | | |

N.B: Numbers in parentheses give the percentage of respondents

The higher percentage of men headed households in the region implies that that since men are the owners of the land, they were also decision makers in Mbeere South and Maara districts. Males' control of all household activities includes deciding what food to grow, what soil technologies to adopt and how to access the information. However, if agricultural production is to be enhanced, farmwoman is to be taught as teaching a (male) farmer is to teach him alone but teaching a (female) farmer is teaching a whole family (Wani, 2000). It is thus important to provide women farmers in both male and female headed households with efficient, effective and appropriate technology, training and information.

The mean age of the household heads was 46 years. The minimum age was 18 years while the oldest respondent was 86 years old. Majority of the farmers from Maara ranged between 46-60 years (40.8%) while majority of the farmers from Mbeere South (45%) ranged between 31-45 years. This implies that, majority of the farmers are energetic and therefore are able to invest on soil fertility for future benefits. According to Onweremadu and Mathews-Njoku (2007), older farmers still hold tenaciously to traditional practices and therefore have a lesser likelihood of willingness to access information on new technologies. It may be also older farmers are more risk averse and less likely to be flexible than younger farmers and thus have a lesser likelihood of information utilization and new technologies.

Education levels were almost equally distributed in Mbeere south and Maara district. Majority of the household heads had education up to primary level, with 60.8% and 58.5% in Mbeere South and Maara, respectively (Figure 4.1).

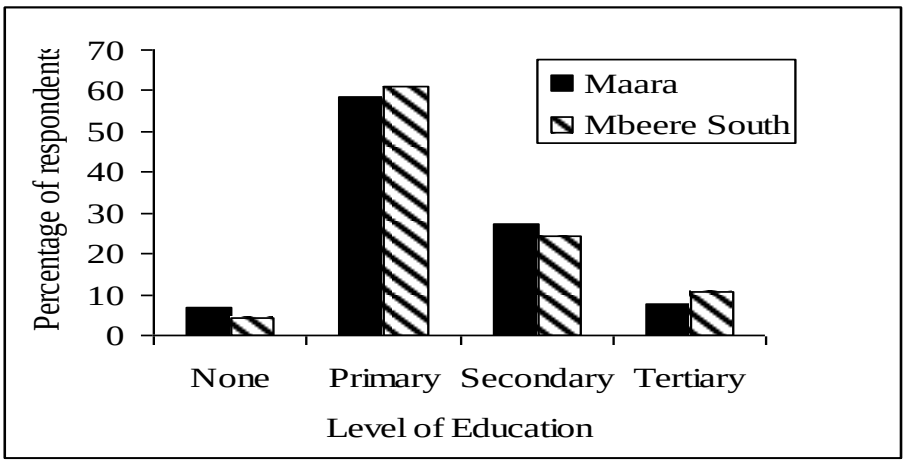



**Figure 4.1:** Distribution of farmers by level of education in both Maara and Mbeere South districts in Central Kenya

This implies that since majority of the household heads had education up to primary level, then farmers' ability to obtain, process and analyse information disseminated by different sources is enhanced. This helps the farmer to make appropriate decision through reading and analyzing in a better way. A study by Katungi (2006) in Uganda revealed that, educated farmers had more access to information than uneducated farmers.

### 4.1.2 Estimated income and social participation of the respondents

There was a significant association between estimated income from farming and districts ($\chi^2$=27.570, P= 0.001). A higher percentage of farmers (62.3 %) who earned an estimated income of above Ksh. 15,000 per season were from Mbeere South as compared to only 37.7% in Maara district (Table 4.2). The explanation for this is probably that farmers in Maara have lesser portions of land compared to those in Mbeere South and therefore seek other off- farm sources of income rather than relying on on-farm income. However, only 5.4% of the respondents earned between Ksh 0-5000 in a season.

**Table 4.2:** Distribution of farmers by estimated income in both Maara and Mbeere South districts in Central Kenya

| **Estimated income from farming** | **Maara** | **Mbeere South** | **Total** | **Chi square($\chi^2$)** | **P value** |
|---|---|---|---|---|---|
| 0-5000 ksh | 6 (46.2) | 7 (53.8) | 13 (100) | 27.570 | 0.001 |
| 5001-10000 ksh | 26 (78.8) | 7 (21.2) | 33 (100) | | |
| 10001-15000 | 33 (70.2) | 14 (29.8) | 47 (100) | | |
| 15000 ksh and above | 55 (37.7) | 91 (62.3) | 146 (100) | | |
| Total | 120 (50.2) | 119 (49.8) | 239 (100) | | |

N.B: Numbers in parentheses give the percentage of respondents

High income earned from the agricultural activities increases the farmers' financial capacity and increases the probability of investing in new agricultural technologies, and owning radio and television that leads to more information access (Yishak, 2005). Therefore, farm income is expected to positively influence access to and utilization of agricultural information. Most of the household heads (84.2%) relied on farming as an occupation while 81.7% of spouses were also in farming. About 11.7% and 12.5% of the household heads in Maara and Mbeere South, respectively, were employed in other forms of careers.

Majority of the farmers, 60.8% and 69.2% in Mbeere South and Maara, respectively belonged to at least one farmer group or local association. About 27 (22.5%) of the respondents in Maara were members of two groups while 2 (1.7%) were members of five groups. Membership into farmer groups enables individuals to have access to capacity building efforts such as training and study tours, and to information pertaining to new agricultural technologies (Katungi, 2006). Membership to groups has also been found to promote adoption of soil fertility management in Meru south district, Kenya (Kirumba, 2009).

### 4.1.3 Farm characteristics

There was a significant relationship between farm size and district ($\chi^2$=44.290, P=0.001), with 42.3% of farmers from Mbeere South possessing more than 3 acres of land in comparison to only 7.5% of the farmers from Maara. The mean farm size for Mbeere South (3.5 acres) was significantly higher than for Maara (1.7 acres) (t =-7.803, P=0.001). Explanation of this observation is due to the high population density (205

persons/$Km^2$) in Maara compared to Mbeere South population density of 105 persons/$Km^2$ (GOK, 2010). In Maara the maximum land under pasture was 3 acres whereas in Mbeere South it was 7 acres. For the purpose of the study, security of tenure was regarded as possession of a title deed in the farmer's name. The title deed is a form of security that enables individuals to secure loans from banks and other money lending institutions. There was significant relationship between possession of title deeds and district (($\chi^2$=21.624. P=0.001) with most of the farmers (63.3%) in Mbeere South possessed title deeds as a form of security while 66.7% of the farmers in Maara did not posses title deeds (Table 4.3).

**Table 4. 3** Security of land tenure and fertility status of farms in Maara and Mbeere South districts in central Kenya

| **Posses of title deed** | **Maara** | **Mbeere South** | **Total** | **Chi square($\chi^2$)** | **P value** |
|---|---|---|---|---|---|
| Yes | 40 (33.3) | 76 (63.3) | 116 (48.3) | 21.624 | 0.001 |
| No | 80 (66.7) | 44 (36.7) | 124 (51.7) | | |
| Total | 120 (100) | 120 (100) | 240 (100) | | |
| **Fertility status** | | | | | |
| High | 42 (70) | 18 (30) | 60 (100) | 13.751 | 0.001 |
| Low | 47 (40.5) | 69 (59.5) | 116 (100) | | |
| Total | 89 (50.6) | 87 (49.4) | 176 (100) | | |

N.B: Numbers in parentheses give the percentage of respondents

Insecurity of tenure can be barriers to increased productivity, diminishing farmers' incentives to sustain resource use over time, thus reduce motivation to seek information on soil fertility management practices (Katungi, 2006).

There was significant association between fertility status of the farms and district ($\chi^2$=13.751, P=0.001). A higher percentage of farmers in Maara (70%) considered their

farms to be fertile compared to farmers in Mbeere South (59.5%). This is possibly because most of the soils in Mbeere South are friable and sandy soils (Onduru et al., 2002) hence lose soil fertility fast. However, 26.6% of the farmers indicated that they did not know the fertility status of their farms. About 48.3% of the farmers considered fertility status of their land to be low. This suggests that farmers would be willing to improve on soil fertility status of their land and thus seek information of soil fertility technologies.

### 4.1.4 Language preference

Majority of the farmers (99.6%) said that they would understand their vernacular language if used as a language to communicate on SFM practices (Figure 4.2). About 50.8% and 83.8%% would understand English and Kiswahili, respectively when used to communicate agricultural information.

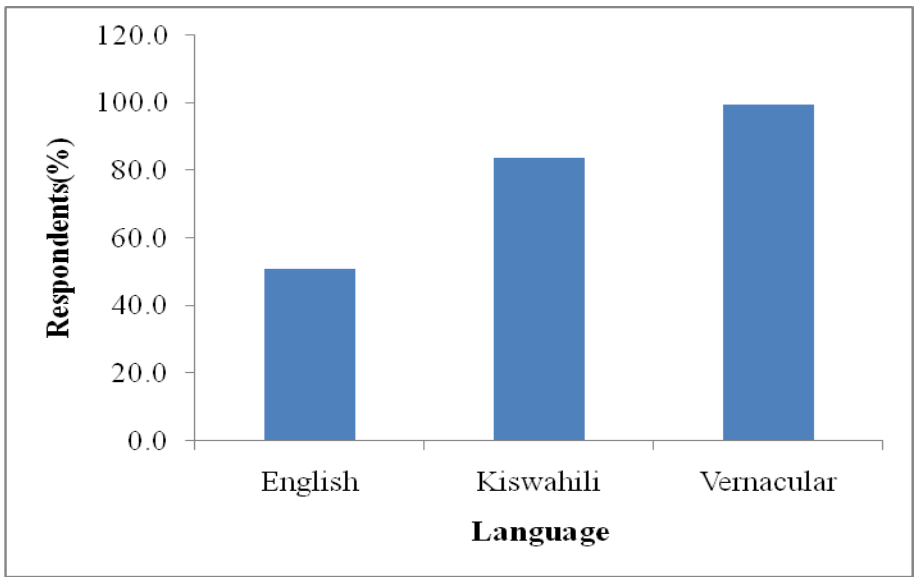



**Figure 4.2:** Languages understood by farmers in Maara and Mbeere South districts in Central Kenya

This implied that vernacular would be the best language to use in communication of soil fertility technologies. This agrees with previous studies by Oladoja et al. (2008) who recommended the use of local language by the change agent in order to communicate to the farmers more effectively.

There was significant relationship between farmers who had been visited by an agricultural officer and district (($\chi^2$=43.719, P= 0.001) where majority (65.5%) of the farmers who had been visited by an agricultural officer were from Maara (Table 4.4). This is possibly because of inadequate infrastructure in Mbeere South district (NCAPD, 2005), which makes it difficult for extension agents to access farmers in Mbeere South district. However, majority of the respondents (67.1%) from Mbeere South said they had never been visited an agricultural officer. This is possibly because extension officers cover a wide area making it difficult to visit all the farmers. This finding agrees with KDLC (2010) who explained that there is limited access to extension services in most parts of the country with the National extension staff: farmer ratio standing at 1:1,500. This situation has hindered most farmers from keeping pace with changing technological advances.

**Table 4. 4:** Farmers who had been visited by an agricultural officer or visited research station in Maara and Mbeere South districts in Central Kenya

| | Visited Research Station | | | | |
|---|---|---|---|---|---|
| **District** | **yes** | **No** | **Total** | **Chi-Square** | **P value** |
| **Maara** | 19 (15.8) | 101 (84.2) | 120 (100) | 3.17 | 0.056 |
| **Mbeere South** | 10 (8.3) | 110 (91.7) | 120 (100) | | |
| **Total** | 29 (12.1) | 211 (87.9) | 240 (100) | | |
| | **Visited by an agricultural officer** | | | | |
| **District** | yes | No | **Total** | | |
| **Maara** | 72 (76.6) | 48 (32.9) | 120 (50) | 43.7 | 0.001 |
| **Mbeere South** | 22 (23.4) | 98 (67.1) | 120 (50) | | |
| **Total** | 94 (100) | 146 (100) | 240 (100) | | |

Furthermore, during the focus group discussions farmers also complained about the lack of regular or meaningful contact with extension agents and researchers. The findings agree with the assertion by Oladosu (2000) that the duration of extension agents in some occasions was too brief to allow meaningful exchange of ideas and understanding.

Approximately 84.2% and 91.7% of the farmers in Maara and Mbeere South, respectively had never visited research station (Table 4.4). The implication is that most of the on-station research does not directly benefit the farmers in improving soil fertility management. Researchers should therefore make great efforts to disseminate technologies they develop, beyond the research stations, by involving extension personnel who interact with farmers more.

### 4.1.5 Availability and reliability of sources of information on soil fertility management

The respondents used more than one source of information to improve their soil fertility needs. Other farmers and government extension agents were the most important sources

of information (Table 4.5). However, the sources of information varied depending on the soil fertility management inputs. Other farmers were the most important source of information for erosion control measures (49.1%), animal manures (27.7%), and inorganic fertilizers (43.2%). About 36.4% of the farmers who used combined organic and inorganic fertilizers and 37.7% of those who used green manure obtained information from government extension officers (Table 4.5). The results support findings by Fekandu (1997) who reported that though knowledge is produced through agricultural research, it is not the only avenue for knowledge generation. This author also reported that learning from experience interaction and farmers' experimentation are other sources. Similarly, Ekoja (2003) explained that most commonly used sources of information in Nigeria include extension agents, neighbors, other farmers, opinion leaders and organized groups.

**Table 4.5:** Sources of information used by farmers to access information on different SFM in Mbeere South and Maara districts in Central Kenya

| Sources of information | Animal manure | Green manure | Inorganic fertilizers | combined organic and inorganic fertilizers | Erosion control measures | Compost |
|---|---|---|---|---|---|---|
| Government extension officer | 50 (22.7) | 20 (37.7) | 65 (28.4) | 78 (36.4) | 43 (19.9) | 9 (12.3) |
| NGO extension officer | 2 (0.9) | 0 (0) | 3 (1.3) | 17 (7.9) | 10 (4.6) | 3 (4.1) |
| Researchers | 4 (1.8) | 13 (24.5) | 6 (2.6) | 10 (4.7) | 2 (0.9) | 2 (2.7) |
| Agro input dealers | 1 (0.5) | 1 (1.9) | 23 (10) | 5 (2.3) | 2 (0.9) | 1 (1.4) |
| Radio/TV | 2 (0.9) | 3 (5.7) | 4 (1.7) | 3 (1.4) | 3 (1.4) | 0 (0) |
| Exhibitions | 1 (0.5) | 0 (0) | 3 (1.3) | 4 (1.9) | 0 (0) | 0 (0) |
| Other farmers | 61 (27.7) | 4 (7.5) | 99 (43.2) | 68 (31.8) | 106 (49.1) | 28 (38.4) |
| Own experience | 99 (45) | 12 (22.6) | 26 (11.4) | 29 (13.6) | 50 (23.1) | 30 (41.1) |
| Total | 220 (100) | 53 (100) | 229 (100) | 214 (100) | 216 (100) | 73 (100) |

N.B: Numbers in parentheses are the percentage of respondents

N=Total number of the farmers who practice the technology

Animal manure, inorganic manure, combination and erosion control were the most common SFM used by farmers

Farmers were requested to score the availability of various sources of information using the scores 1=Never available, 2=least available, 3=Available, 4=most available. The most available sources of information on soil fertility management, as perceived by farmers, were other farmers and radio, with a mean score of 3.8 and 3.6, respectively (Table 4.6). This was followed by government extension workers, with a mean score of 2.2 (Table 4.6).

**Table 4.6:** Availability of information sources on SFM as scored by farmers in Maara and Mbeere South districts in Central Kenya

| Sources of Information | Never available | Least Available | Available | Most available | Mean |
|---|---|---|---|---|---|
| Other farmers | 2(0.8) | 2(0.8) | 35(14.6) | 201(83.8) | 3.8 |
| Radio/TV | 2(0.8) | 3(1.3) | 78(32.5) | 157(65.4) | 3.6 |
| Government extension worker | 0(0.0) | 107(44.6) | 54(22.5) | 26(10.8) | 2.2 |
| Exhibition/shows | 83(34.6) | 104(43.3) | 38(15.8) | 15(6.3) | 1.9 |
| Researchers | 107(44.6) | 92(38.3) | 40(16.7) | 1(0.4) | 1.7 |
| Agro-input-dealers | 147(61.3) | 38(15.8) | 43(17.9) | 12(5.0) | 1.7 |
| NGO extension worker | 140(58.3) | 72(30.0) | 27(11.3) | 1(0.4) | 1.5 |
| Print media | 154(64.2) | 56(23.3) | 23(9.6) | 7(2.9) | 1.5 |

N.B: Numbers in parentheses are the percentage of respondents. N=240

The implication of these results is that farmers seek information from other farmers more than the other sources. This is probably because they are easily accessible while they have limited access to other agricultural personnel such as researchers or NGOs.

The possible reason why radio was highly scored as an available source of information for SFM was that most respondents possessed a radio. In addition, the radio as mass communication method reaches many farmers within a short time compared to other

knowledge sharing tools. However, some participants objected relying on the radio programs because of the inappropriateness of the broadcasting time. These programs are broadcasted when farmers are away in the fields or too tired to listen after the day's toil.

The mean score for NGOs was 1.5 which was ranked as position 7 overall (Table 4.6). This was possibly because most of the NGOs are not enormous and their activities though intensive are restricted to a few beneficiary farmers or at most to a few villages. In addition some NGOs are lacking in capacity in terms of staff, facilities and technological expertise (Omolo et al., 2001). NGOs extension programs can be encouraged by the state through both official recognition and technical assistance (Kandie, 1997).

Other farmers were perceived as the most reliable source of information of all soil fertility management inputs with a mean of 3.9 (Table 4.7). Similarly, Maddox et al. (2003) found other farmers to be a major source of information in North Carolina. In support of these results, Sulaiman and Sadamate (2000) reported that in India farmer dependence on other farmers as sources of information continues to be high.

**Table 4.7:** Reliability of sources of information on different SFM practices as scored by farmers in Maara and Mbeere South districts in Central Kenya

| Sources of information | Animal manure (N=240) | Green manure (N=204) | Fertilizer (N=240) | Compost (N=240) | Combined Fertilizers and manure (N=227) | Erosion control measures (N=240) | mean |
|---|---|---|---|---|---|---|---|
| Other farmers | 3.4 | 2.8 | 3.1 | 2.8 | 3.1 | 3.3 | 3.1 |
| Government | | | | | | | |
| Extension workers | 2.5 | 2.0 | 3.1 | 2.7 | 2.7 | 2.7 | 2.6 |
| Researchers | 1.9 | 1.7 | 2.2 | 1.8 | 2.0 | 2.1 | 1.9 |
| Radio/TV | 1.9 | 1.6 | 1.9 | 1.9 | 1.8 | 1.9 | 1.8 |
| NGOs | 1.6 | 1.4 | 2.0 | 2.0 | 1.8 | 1.8 | 1. 8 |
| Exhibitions | 1.6 | 1.5 | 1.7 | 1.6 | 1.7 | 1.7 | 1.7 |
| Print media | 1.4 | 1.4 | 1.6 | 1.4 | 1.5 | 1.6 | 1.5 |
| Input stockists | 1.3 | 1.2 | 1.8 | 1.3 | 1.6 | 1.6 | 1.5 |
| Total | 2.0 | 1.7 | 2.2 | 1.9 | 2.0 | 2.1 | 2 |

The second most scored source in regard to reliability was government extension officers with a mean score of 2.6 (Table 4.7). Explanation for this observation is that majority of the farmers are aware of the existence of government extension agents and that there are more government extension officers compared to other agricultural stakeholders involved in dissemination of soil fertility research findings. Agro input dealers were the least scored with a computed mean of 1.47 but ranked ($6^{th}$) on reliability of fertilizer information.

**Availability versus reliability of information sources on soil fertility management practice**s

Other farmers and radio/TV were considered as the most available source of information, and the most reliable source of information on soil fertility. Radio/TV ranked second on its availability but forth on its reliability. The farmers also indicated that researchers were not very accessible as they ranked fifth but are more reliable third (Figure 4.3).

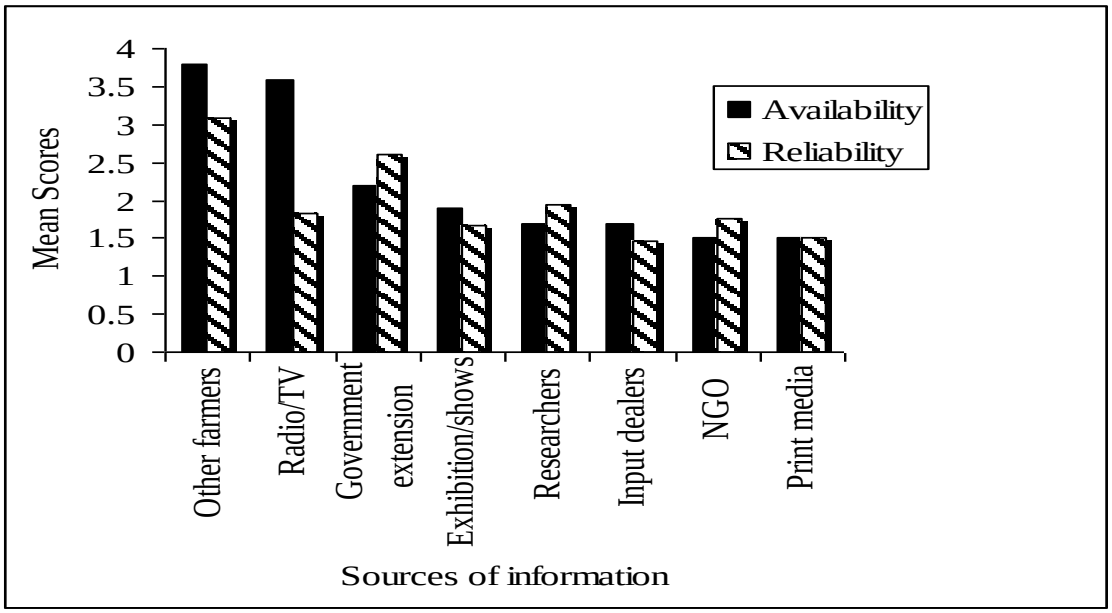



**Figure 4.3**: Comparison of availability and reliability of information sources on SFM practices as scored by farmers in Maara and Mbeere South districts in Central Kenya

An important finding was that radio was perceived as most available but not very reliable according to farmers. These results suggest that more reliable information related to soil fertility should be broadcasted through the radio to make use of its availability. In addition researchers, extension agents and NGOs should increase their interaction with the farmers for better delivery of soil fertility messages.

The results generally indicated that there was a positive correlation between availability of information source and its reliability at (r= 0.65). This implies that the more available the source of information the more its reliability by the farmers. Researchers in previous studies (Rezvanfar et al., 2009) reported that access to information sources and communication channels and adequate number of extension education courses with relevant content may increase awareness about the effects and consequences of sustainable soil conservation practices among farmers while providing them with required knowledge.

Farmers had access to different types of print media to gain knowledge on soil fertility management. Posters were the most commonly read print media by 38.3%, 29.6% and 26.3% farmers on fertilizers, green manure and animal manure, respectively (Table 4.8). Few (4.7% and 7.5%) had read newsletters and magazines on green manure, respectively. Majority (27.5%) of the farmers had read manuals on combined fertilizers and manure while 26.3% have read manual to gain knowledge on soil erosion measures (Table 4.8).

**Table 4.8**: Types of print media read to gain knowledge on SFM by farmers in Mbeere South and Maara in Central Kenya

| | SFM practices | | | | | |
|---|---|---|---|---|---|---|
| **Print media** | **Animal manure** | **Green manure** | **Fertilizer** | **Compost** | **Combined fertilizer and manure** | **Soil Erosion** |
| Posters | 63(26.3) | 71(29.6) | 92(38.3) | 3(14.6) | 65(27.1) | 48(20.0) |
| Manuals | 53(22.1) | 38(15.8) | 86(35.8) | 38(15.8) | 66(27.5) | 63(26.3) |
| Brochures | 43(17.9) | 33(13.8) | 60(25.0) | 54(22.5) | 57(23.8) | 5(21.7) |
| Newspaper | 45(18.8) | 27(11.3) | 69(28.8) | 65(27.1) | 50(20.8) | 48(20.0) |
| Magazines | 27(11.3) | 18(7.5) | 49(20.4) | 25(10.4) | 52(21.7) | 42(17.5) |
| Newsletters | 27(11.3) | 11(4.6) | 47(19.6) | 25(10.4) | 36(15.0) | 31(12.9) |

N.B: Numbers in parentheses are the percentage of respondents N=240

The possible reason why majority of the farmers had read posters could be attributed to the fact that posters are not complex and even farmers with very little education can grasp the message from the poster (Gloy et al., 2000).

### 4.1.6 Methods used in dissemination of soil fertility management practices

A wide array of extension methods had been used to disseminate information on SFM practices. These include, demonstration, farmer field schools (FFS), field days, exchange visit, workshops and farmer to farmer extension methods. Majority (99.3%) of the farmers who used animal manure as a way of improving soil fertility reported being trained using demonstration. About 51.5% and 43.1% of the farmers who practiced soil erosion control measures and used inorganic fertilizers, respectively had been trained through the farmer to farmer extension method (Table 4.9). Out of the 38 farmers who used green manure, 55.3% were trained through demonstration method while farmer to farmer extension method was used to train 43.1% of the farmers who used compost (Table 4.9).

**Table 4. 9:** Methods used to train farmers on SFM practices in Mbeere South and Maara districts in Central Kenya

| SFM Practice | Animal Manure | Green manure | Inorganic fertilizers | Combined organic and inorganic fertilizers | Erosion control measures | Compost |
|---|---|---|---|---|---|---|
| Demonstration | 140 (99.3) | 21 (55.3) | 50 (25.4) | 46 (26.1) | 56 (33.5) | 16 (27.6) |
| Exchange visit | **1 (0.7)** | 1 (2.6) | 14 (7.1) | 12 (6.8) | 10 (6) | 2 (3.4) |
| Field days | 0 (0) | 13 (34.2) | 33 (16.8) | 38 (21.6) | 8 (4.8) | 12 (20.7) |
| FFS | 0 (0) | 0 (0) | 4 (2) | 10 (5.7) | 2 (1.2) | 2 (3.4) |
| Workshop | 0 (0) | 1 (2.6) | 11 (5.6) | 13 (7.4) | 5 (3) | 1 (1.7) |
| Farmer to farmer extension | 0 (0) | 2 (5.3) | 85 (43.1) | 57 (32.4) | 86 (51.5) | 25 (43.1) |
| Total (N) | 141 (100) | 38 (100) | 197 (100) | 176 (100) | 167 (100) | 58 (100) |

This indicates that different extension methods were used to train farmers on soil fertility management practices. The results also indicate that some methods such as exchange visit, FFS and workshops were not commonly used to disseminate information on soil fertility management practices. This is probably because the latter methods are not organised more often due to the limiting factors such as the number to be trained and financial implications. However, the high use of demonstration and farmer to farmer extension methods was possibly because the methods are sustainable, have no language barriers and both literate and illiterate people learn best by seeing (Farouque and Takeya, 2009).

Farmers were requested to score the preference of various approaches of communication using the scores 1= do not prefer, 2= mildly prefer, 3= strongly prefer. Majority of the farmers (67.1%) strongly preferred individual farmer interaction method while only 13.3% of the farmers strongly preferred mass media (Figure 4.4). About 48.3% and 44.2% of the farmers mildly and strongly preferred group approach, respectively (Figure 4.4).

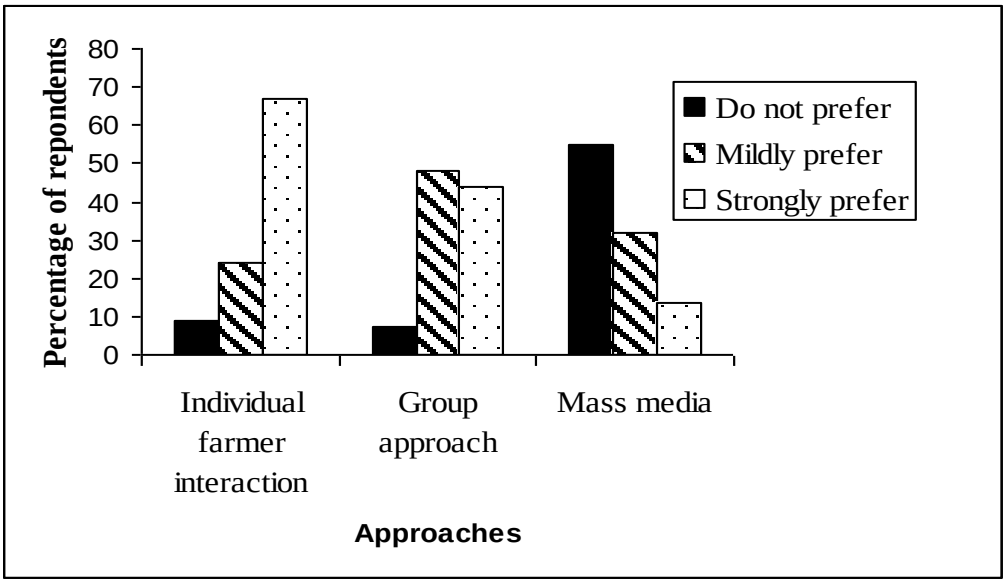



**Figure 4.4:** Preferred approaches by farmers in Maara and Mbeere South districts in central Kenya

The results indicate that farmers would like to be visited in their own individual farms or be given individual attention by the extension agents. This observation agrees with results of, Farouque and Takeya (2009) who reported that individual teaching methods were superior for instilling conviction and motivating action. Similarly, Okunade (2007) reported that individual method enhances interaction which may enhance much emphasis on the technology thereby enhancing better understanding. The low preference for mass media would be attributed to the one way communication mechanism where farmers do not have a chance to communicate their needs and priorities to the source of information. This agrees with the findings of Reisenberg and Gor (1989) that farmers least preferred the mass media method as a mode of communication. On the other hand, Martin and Omar (1988) indicated in their study that younger Iowa farmers preferred group orientated delivery methods such as Extension community meetings (group face-to-face methods).

Results of the current study showed that, different radio programmes benefited farmers on soil fertility management. “Mugambo wa Murimi”, a program of Inooro FM was the most listened to program by most farmers (36.3%), while 20%, 7.1% and 3.3% benefited from Muga, KBC and Coro station programmes, respectively (Table 4.10).

**Table 4. 10:** Programmes that benefit farmers on SFM practices in Maara and Mbeere South districts

| Station | Programme | No .of Farmers | Percent (%) |
|---|---|---|---|
| Muga | Kanju ka murimi | 48 | 20 |
| Inooro | Mugaambo wa murimi | 87 | 36.3 |
| KBC | | 17 | 7.1 |
| Citizen | Kilimo bora | 29 | 12.1 |
| Coro | | 8 | 3.3 |
| Kameme | Murimi mwega | 8 | 3.3 |

The implication of the findings is that farmers prefer radio programmes presented in their own vernacular. This agrees with the findings of Garforth (1998) who found that people adopt information faster when radio programs are aired in local languages as they know that it is done by one of their own as no outsider can converse in their language fluently.

### 4.1.7 Communication methods preferred by farmers

Farmers were requested to score the preference of various approaches of communication using the scores 1= not preferred, 2= least preferred, 3= fairly preferred, 4=Most preferred. Demonstration was the most preferred method in training in the use of animal manure, fertilizers and combined fertilizers and manure with a mean score of 3.1, 3.2 and 3.4, respectively (Table 4.11). Farmer to farmer extension was given the highest score in training in the use of green manure (3.0) and soil erosion control measures (3.1). Farmer field school was the most preferred in training on compost with a mean score of 3.5. Overall, demonstration (3.1) was the highest preferred method followed by farmer to

farmer extension method (3.0) and workshop, respectively, in dissemination of SFM practices (Table 4.11). This indicates that channels of communication are not preferred equally by farmers (Ekoja, 2003). In support of these results, another study asking specifically about farmers' information sources for environmental issues found on-farm demonstration as the most preferred communication channel in North Carolina (Bruening, 1991). Similarly, Ngathou et al. (2006) found communication among farmers to be one of the best sources of information disbursement in a study in North Alabama. In line with this, Yishak (2005), in a study on determinants of adoption of improved maize technology in Damote- Galewereda, Wolaita, Ethiopia reported that ownership of radio and participation in demonstration had positive influence on adoption of improved maize varieties.

**Table 4.11:** Communication methods preferred for the different SFM practices by farmers in Maara and Mbeere South districts in Central Kenya

| Communication methods used in teaching farmers | Animal manure | Green manure | Fertilizers | Erosion control measures | Compost | Combined fertilizers and manure | Average |
|---|---|---|---|---|---|---|---|
| Demonstration | 3.1 | 2.9 | 3.2 | 2.9 | 3.0 | 3.4 | 3.1 |
| Farmer to farmer extension | 2.9 | 3.0 | 2.9 | 3.1 | 3.0 | 3.2 | 3.0 |
| Workshops | 2.3 | 2.2 | 2.5 | 2.5 | 1.9 | 2.5 | 2.3 |
| Farmer field school | 1.8 | 1.7 | 2.2 | 2.6 | 3.5 | 1.9 | 2.2 |
| Field days | 2.1 | 2.0 | 2.5 | 2.3 | 2.1 | 2.2 | 2.2 |
| Teaching aids | 2.0 | 2.0 | 2.2 | 2.2 | 2.2 | 2.1 | 2.1 |
| Exchange visits | 2.0 | 1.9 | 2.1 | 2.2 | 1.9 | 2.0 | 2.0 |
| Total | 2.3 | 2.2 | 2.5 | 2.5 | 2.5 | 2.5 | 2.4 |

N=240

### 4.1.8 Characteristics of good communicators

Farmers were requested to score the characteristics of good communicators using the scores 1= Not important, 2= fairly important, 3= important, 4= Very important. A person who listens to farmers needs and responds was considered as the best communicator with a mean score of 3.7 followed by a person who encourages farmers' participation with a mean score of 3.6 (Table 4.12). During the focus group discussions (FGDs) farmers stressed that appearance or modes of dressing may positively influence or could cause undesirable distractions as information is transferred from a source to a receiver.

**Table 4.12:** Characteristics of good communicators as perceived by farmers in Mbeere South and Maara in Central Kenya

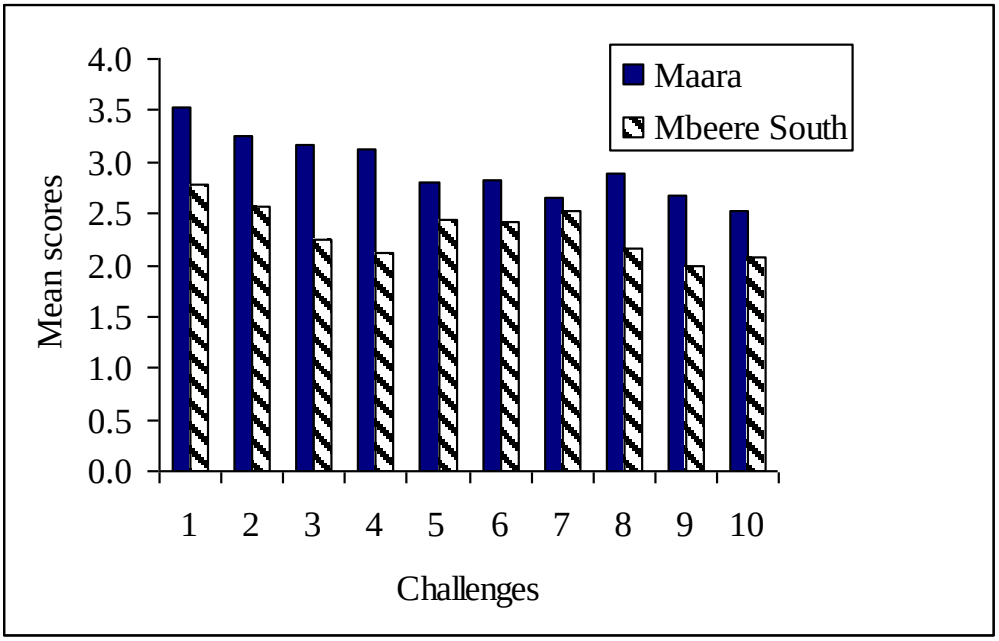
| Characteristics of good communicators | Maara | Mbeere South | Average |
|---|---|---|---|
| Listens to farmers needs and responds | 3.6 | 3.8 | 3.7 |
| Encourages farmers' participation | 3.7 | 3.4 | 3.6 |
| Demonstrates | 3.7 | 3.5 | 3.5 |
| Motivating | 3.6 | 3.8 | 3.5 |
| Uses simple terms to express his views | 3.7 | 3.1 | 3.4 |
| Gives real life example | 3.3 | 3.4 | 3.3 |
| Locally available resources to train | 3.4 | 3.2 | 3.3 |
| A jovial person | 3.5 | 2.9 | 3.2 |
| Uses teaching aids | 3.0 | 2.8 | 2.9 |

Maara N=120, Mbeere South N=120

The implication is that extension agents should aim to possess a combination of the above characteristics. A study by Mulogoli (1996) explained that in order to enhance retention during communication, humour should be used to stop build up of stress and diffuse tension. According to Onasanya (2006), the personality of the key players in communication affects coding and decoding process in communication. Moreover, good delivery of a presentation enhances its content while poor delivery can undermine it (Mulogoli, 1996).

### 4.1.9 Challenges that hinder effective communication of SFM practices as perceived by the farmers

Although different farmers prioritized different challenges, resource constrain was perceived as a very serious challenge that hinder communication of SFM information in both Maara and Mbeere South with a mean score of 3.53 and 2.78, respectively (Figure 4.5). Lack of individual follow up by farmers was considered as a very serious challenge by 74 (30.8 %) of the farmers. However, inadequate literature materials were scored the least with a mean score of 2.30 (Figure 4.5) possibly because mass media was lowly preferred (Figure 4.5) as a source of information.




**Key**

| | | | |
|---|---|---|---|
| 1.Resource constraints | 4.Very sophisticated terms | 7.Repetition of the information | 10.Inadequate literature materials |
| 2.No individual follow up | 5.Low literacy among farmers | 8.Information not related to their problems | |
| 3.Poor attitude towards extension workers | 6.Lack of discussion groups | 9.Not Practical Oriented | |

**Figure 4.5** Challenges that hinder effective communication of SFM practices as perceived by the farmers in Mbeere South and Maara districts in Central Kenya

Furthermore, extension agents and researchers commonly use group approach to reach farmers thus individual follow up may not have been possible. The findings agree with Kamau et al. (2002) who noted that financial constraints at community level are a cross-cutting issue in up-scaling adoption of agricultural technologies. Similarly, Mutimba (2004) in a study on promoting soil and water technologies argues that for most recommendations on soil and water conservation, farmers do not have resources to implement them and as a result they implement them partially or not at all due to scarcity of resources for the recommended technologies.

### 4.1.10 Relationship between social economic factors and preference of extension methods used in communication of SFM practices

A Pearson test was done between the continuous independent variables and the dependent variables while Spearman test was done between the discrete independent variables and dependent variables to test on their correlation. There was a significant negative correlation ($r=-0.194$, $P\leq0.01$) between gender and the use of field days in teaching on animal manure but a significant positive correlation ($r=0.166$, $P\leq0.01$) between gender and use of workshops as an extension method of training on animal manure (Table 4.13). This suggests that women had a higher preference for workshop while men have a higher preference for field days in teaching on the use of animal manure as a technology of improving soil fertility. The possible reason for preference of workshop by women as an extension method in teaching on animal manure instead of field days would be because workshops are more likely to give more detailed information on animal manure which women often lack. A study conducted by Habtemariam (2004) revealed that male-headed

households are said to have better access to agricultural information than female headed households, which is attributed to negative influence of cultural norms and traditions. Shadiadeh (2006) explained that extension does not often get information to women due to time schedules that are not appropriate to women while as men have flexible time schedules and therefore are able to access information from different sources.

**Table 4.13**: Correlation between socio- economic factors of farmers and preference of extension methods in training SFM practices in Maara and Mbeere South districts

| Extension method | SFM practice | Pearson test | | | Spearman correlation | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| Field days | Animal manure | 0.007 | -0.028 | 0.035 | 0.208** | -0.045 | -0.194** | -0.067 | -0.001 |
| Field days | Green manure | 0.021 | -0.043 | 0.049 | 0.140* | -0.047 | -0.048 | -0.008 | -0.002 |
| FFS | Animal manure | -0.075 | 0.281** | -0.002 | 0.202** | -0.07 | -0.029 | -0.024 | -0.071 |
| FFS | Green manure | -0.014 | 0.194** | -0.119 | 0.007 | -0.015 | 0.033 | 0.03 | -0.06 |
| FFS | Fertilizers | -0.078 | 0.313** | -0.078 | 0.004 | -0.027 | 0.109 | 0.025 | -0.1 |
| Demonstrations | Animal manure | 0.102 | -0.063 | -0.006 | 0.141* | -0.029 | -0.119 | -0.012 | -0.183** |
| Demonstrations | Fertilizers | 0.048 | -0.075 | -0.064 | 0.128* | -0.047 | -0.092 | -0.005 | -0.156** |
| Demonstrations | Green manure | 0.158* | -0.132* | -0.036 | 0.114* | 0.06 | -0.184** | 0.008 | -0.162** |
| Exchange visits | Animal manure | -0.007 | -0.037 | 0.127* | 0.05 | 0.027 | -0.122* | 0.003 | 0.054 |
| Exchange visits | Green manure | 0.037 | -0.144* | 0.035 | -0.01 | 0.033 | -0.142* | -0.049 | 0.02 |
| Exchange visits | Fertilizers | -0.039 | 0.033 | 0.041 | -0.021 | 0.001 | -0.148* | 0.01 | -0.007 |
| Workshops | Animal manure | -0.028 | 0.169** | 0.036 | -0.013 | -0.082 | 0.162** | 0.005 | -0.049 |
| Workshops | Green manure | -0.115 | 0.012 | -0.119 | -0.102 | -0.125* | 0.037 | 0.008 | -0.099 |
| Workshops | Fertilizers | 0.148* | 0.180** | -0.051 | -0.021 | -0.175** | 0.166** | -0.002 | -0.09 |

1.Age of household head-Continuous
2. total farm size- Continuous
3.Membership of the group –Continuous
4.Non formal trainings1=None, 2=1-5 times, 3=5-10 times, 4=More than 5 times
5. Years of farming experience. 1=<10yrs, 2=11-20yrs 3=>20yrs
6 Gender of household head 1=Male, 2=Female
7.Educational level1=None, 2=Primary, 3=Secondary, 4=Tertiary
8Wealth status 1=Rich, 2=Middle, 3=Poor

Note:*significant at $P \leq 0.05$ **significant at $P \leq 0.01$

There was a significant positive correlation (r=0.158, P≤0.05) between age and demonstration as an extension method but a significant negative correlation (r=-0.115, P≤0.05) between age and the use of workshop in teaching on the use of green manure (Table 4.13). This implies that older farmers preferred demonstration to workshops while being taught on green manure. These results corroborate the findings of Knowles (1980) who reported that adults amass experience over time and therefore learn best by experience and by using experiential techniques, rather than learning passively.

There was positive significant correlation (r=0.208, P≤0.01) between the number of non formal trainings attended by the farmer and the use of field days in teaching on the use of animal manure while there was a non significant negative correlation (r=-0.001) between number of non formal trainings and the use of farmer field school in teaching on the use of animal manure (Table 4.13). These findings indicate that farmers who have attended many non formal trainings could be more familiar with the use of inorganic fertilizer hence do not require intensive trainings as given during the FFS.

There was significant negative correlation (r=-0.175, P≤0.01) between the years of experience and the use of workshop/seminar as an extension method in teaching on inorganic fertilizers but a positive significant correlation (r=0.180, P≤0.01) between the size of the farm and the use of workshop/ seminar extension method in teaching on fertilizers (Table 4.13). The possible reason is that farmers with longer farming experience have accumulated farming knowledge and skill which contributes to utilization of agricultural technologies thus the experienced farmer may not require

intensive training on fertilizers. The findings imply that farmers who posses large pieces of land, with or without many years of experience prefer workshop/seminar as a method of teaching on the use of inorganic fertilizers. In another study conducted by Mendis and Udomsade (2005) related to adoption reported that land size significantly influenced the adoption of fertilizer management practices thus farmers with large sizes of land are more enthusiastic to learn more on the use of inorganic fertilizers.

There was significant negative correlation (r=-0.183, P=0.01) between wealth status and preference for demonstration as an extension method in training on animal manure (Table 4.13). However, there was also a negative correlation in preference for demonstration in training of inorganic fertilizers and green manure at 1% probability level. This implies that the poor farmers are likely not to prefer demonstration as an extension possibly because it is conducted in groups. This is probably due to poor farmers feeling inferior in terms of cultural, social and economical considerations and as such is not willing to participate in group events (Farouque and Takeya, 2009).

### 4.1.11 Socio-economic factors that predict the preference of field days as an extension method in training on animal manure

Based on the study findings, field days was the most commonly used method by extension agents and researchers yet it ranked five (5 out of 7) in terms of preference by the farmers. There was therefore the need for the researcher to determine the farmers' socio-economic characteristics that influence its preference by the farmers in training on animal manure through a logistic regression model. The results showed that six variables significantly influenced the preference of field days in training of animal manure at 0.05

levels. These included gender, education, non formal training, membership of group, farm size and number of times visited by an extension agent (Table 4.14)

**Table 4.14**: Parameter estimates of the logistic regression model for the social economic factors likely to influence the preference of field days in training of animal manure

| Independent Variable | B | S.E. | Wald | Sig. | Exp(B) |
|---|---|---|---|---|---|
| Gender | -0.965 | 0.352 | 7.506 | 0.006 | 0.381 |
| Education level | -0.488 | 0.227 | 4.621 | 0.032 | 0.614 |
| Non formal training | 0.678 | 0.236 | 8.219 | 0.004 | 1.970 |
| Attitude extension workers | -0.438 | 0.272 | 2.596 | 0.107 | 0.646 |
| Membership of group | 0.700 | 0.345 | 4.117 | 0.042 | 2.014 |
| Farm size | 1.035 | 0.225 | 21.156 | 0.000 | 2.815 |
| Number of times visited by an Agricultural officer | 1.427 | 0.335 | 18.175 | 0.000 | 4.165 |
| Constant | -2.709 | 1.328 | 4.163 | 0.041 | 0.067 |

Correctly predicted preferred as preferred 83.0%
Correctly predicted not preferred as not preferred 59.3%
Overall percentage predicted 73.9%
Dependent variable=Preference of field days to train on animal manure (Not preferred=1, preferred=2)
N=240
Model chi-square 75.204

The model had a good explanatory power and correctly predicted 73.9% of those respondents who had low and high preference of field days in training of animal manure. Gender negatively influenced the preference of field days significantly (β=-0.965. P=0.006) (Table 4.14) thus indicating that male farmers were more likely to prefer field days in the training of animal manure than the female farmers. This is possibly because rural women have less available time and mobility due to their dual domestic and agricultural roles (FAO, 1996). Education was found to be a significant predictor in preference of field days in training of animal manure (β=-0.488, P=0.032) implying that less educated farmers are more likely to prefer field days than more educated farmers.

This agrees with the findings of Bukenya et al. (2008) that more educated farmers are often more reluctant to learn with other farmers or groups**.**

Number of non formal trainings positively influenced (β=0.678, P=0.004) preference of field days as an extension method in training on animal manure (Table 4.14). This implies that farmers who had attended non formal training are likely to prefer field days as an extension method in training on animal manure. This agrees with the findings of Tsion (2008) who reported that non formal trainings kept the trained farmers more informed and updated on extension packages disseminated by Agricultural Research Centers Attitude toward extension agents (β=-0.438, P=0.107) was not a significant predictor in preference of field days as an extension method in training of animal manure (Table 4.14). However, Rezvanfar et al. (2009) found that farmers with favourable attitude will more probably accept change agents' useful advice enthusiastically and follow their instructions**.**

Total farm size was a significant variable (β=1.035**,** P=0.001) in prediction of preference of field days in training of animal manure (Table 4.14). The farmer with large portion of land is more likely eager to gain information on improving soil fertility status of their land thus could attend field days to learn more on animal manure. A study by Kipsat (2007) reported that operators of large farms are likely to spend more time and resources on soil fertility technologies to avoid risks of crop failure. The number of groups that a farmer belonged positively influenced the preference of field days implying that the more groups the farmers belong the higher the probability they will prefer field days as an

extension method in training of animal manure. Group membership increases interaction among the farmers which may change farmers' attitude towards extension approaches.

There was a positive significant correlation (β=1.427, P=0.024) between visitation by an extension agent and preference of field days which implied that farmers who had been visited many times by an extension are likely to prefer field days in training of animal manure (Table 4.14). This finding is supported by Rogers (1995) generalizations which indicate that as individuals have more contacts with extension services, they make use of the available channels of communication.

It is clear that gender, education, number of non formal trainings attended, farm size, number of groups that a farmer belongs and number of times a farmer had been visited by an extension agent were significant predictors of preference of field days in training of animal manure. Based on the current study findings, field days was the most commonly used extension method in training of soil fertility management practices by researchers and extension agents. This therefore calls for agricultural stakeholders to consider the significant farmers' socio-economic factors that influence the preference of field days as an extension method in promotion of animal manure.

## 4.2 Extension agents

### 4.2.1 Social demographic characteristics of extension agents

The mean age of extension agents in Maara, Meru South, Mbeere South and Embu districts was 45, 48, 46 and 47, respectively. Most (53.3%) of the extension officers ranged between 41-50 years. However, out of the 19 extension agents from Maara, 36.8%

were between 51-60 years while 31.6% ranged between 25-40 years of age (Figure 4.6).

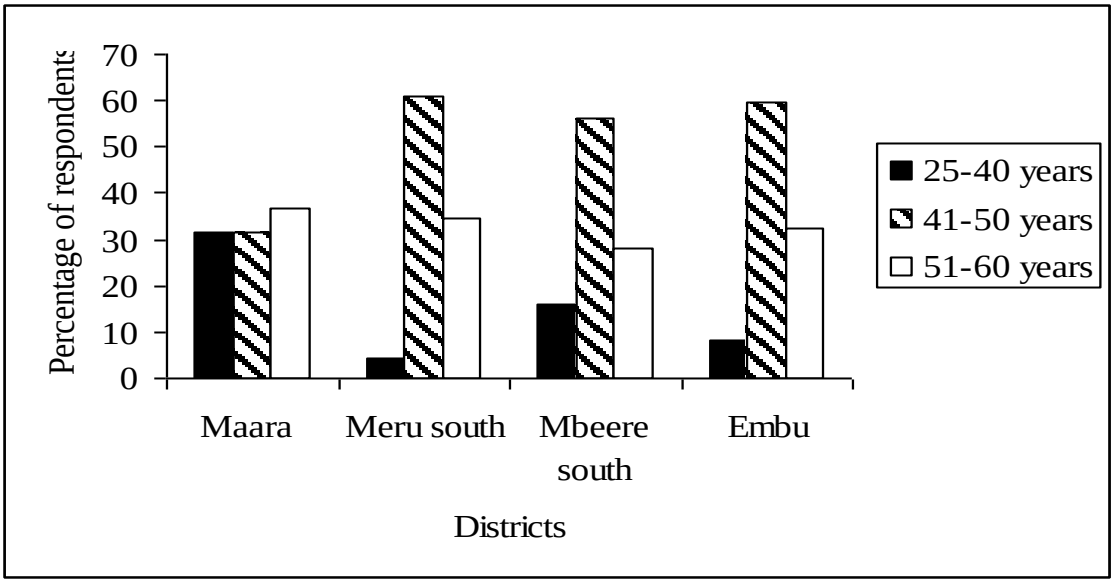



**Figure 4.6** Distribution of extension agents in Maara, Meru South, Mbeere South and Embu districts by age categories

Most (50.5%) of the extension officers were certificate holders followed by 29.5% with diploma certificates (Table 4.15). A higher percentage (38.5%) of the extension officers who had attained degree certificates were from Maara district. Only 3 extension agents out of 105 extension agents had attained masters' degree. Out of the 105 extension agents, 78.1% of the extension agents had more than 15 years of experience (Table 4.15). However, 31.6%, of the extension agents from Maara district had less than 10 years of experience. Majority (51%) of the extension agents were frontline extension workers. Approximately 46% and 30.4% of the extension workers from Mbeere South and Meru South respectively had their responsibilities in crop development.

**Table 4.15:** Social demographic characteristics of extension agents in Maara, Meru South, Mbeere South and Embu districts

| | Districts | | | | |
|---|---|---|---|---|---|
| **Gender** | **Maara** | **Meru South** | **Mbeere South** | **Embu** | **Total** |
| Male | 9 (47.4) | 17 (73.9) | 16 (64) | 14 (36.8) | 56 (53.3) |
| Female | 10 (52.6) | 6 (26.1) | 9 (36) | 24 (63.2) | 49 (46.7) |
| Total | 19 (100) | 23 (100) | 25 (100) | 38 (100) | 105 (100) |
| **Level of education** | | | | | |
| Certificate | 9 (47.4) | 11 (47.8) | 14 (56) | 19 (50) | 53 (50.5) |
| Diploma | 4 (21.1) | 7 (30.4) | 8 (32) | 12 (31.6) | 31 (29.5) |
| Higher diploma | 0 | 0 | 1 (4) | 0 | 1 (1) |
| Degree | 5 (26.3) | 2 (8.7) | 2 (8) | 4 (10.5) | 13 (12.4) |
| Masters | 1 (5.3) | 1 (4.3) | 0 | 1 (2.6) | 3 (2.9) |
| Others | (0) | 2 (8.7) | 0 | 2 (5.3) | 4 (3.8) |
| Total | 19 (100) | 23 (100) | 25 (100) | 38 (100) | 105 (100) |
| **Years of experience** | | | | | |
| < 5 years | 3 (15.8) | 0 | 3 (12) | 2 (5.3) | 8 (7.6) |
| 5-10years | 3 (15.8) | 0 | 0 | 1 (2.6) | 4 (3.8) |
| 10-15years | 2 (10.5) | 2 (8.7) | 2 (8) | 5 (13.2) | 11 (10.5) |
| > 15 years | 11 (57.9) | 21 (91.3) | 20 (80) | 30 (78.9) | 82 (78.1) |
| Total | 19 (100) | 23 (100) | 25 (100) | 38 (100) | 105 (100) |

N.B: Numbers in parentheses give the percentage of respondents

The results show that majority of the extension agents were middle aged, had at least one form of education or the other with average years of experience. This implies that the extension agents in the study area have a lot of potential to explore the various extension methods in teaching of soil fertility management practices. These variables would also serve as a guide to other agricultural stakeholders to determine which communication channels should be used in transfer of information on SFM to the extension agents.

### 4.2.2 Communication methods and approaches used by extension agents

In the quest to promote agricultural development, extension agents have been using various methods including farmer group approaches, individual farmer approaches and mass media approaches. The most commonly used approach by extension agents was

group approach (88.6 %) with a mean of 2.90 (Figure 4.7) while 75.8% of the extension agents had not used mass media approach at all and had a mean of 1.22 (Figure 4.7). About 59.2% of the extension agents moderately used individual contact method while only 1% had not used it at all.

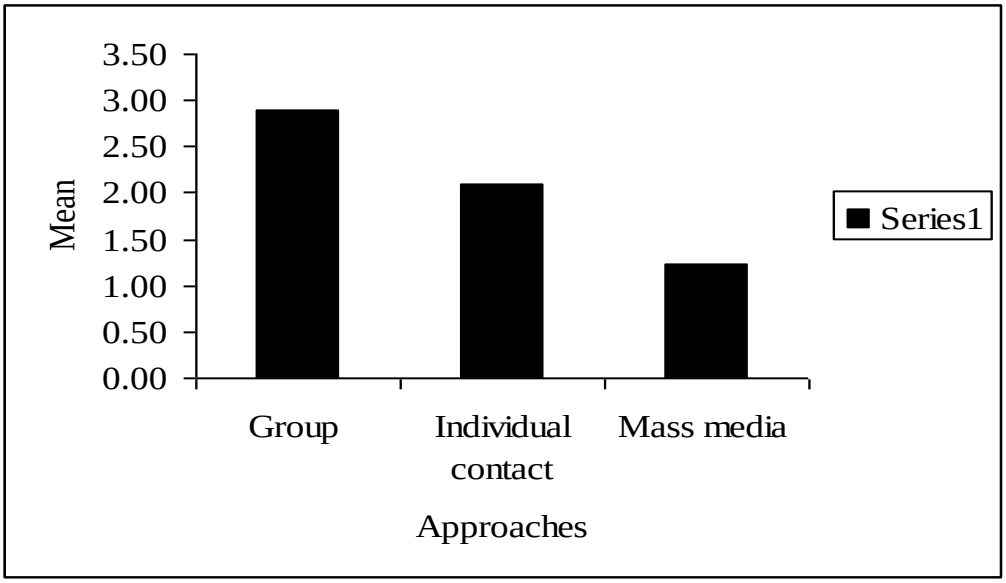



**Figure 4.7:** Communication approaches used by extension agents in Maara, Meru South, Mbeere South and Embu districts
Group approach N=105, Individual approach N=103, Mass Media N=95

The preference of group approach by extension agents is attributed to the benefits associated with groups such as exchange of ideas and experiences among group members, techniques are demonstrated to several people at one time as well as joint action and monitoring each others work. The low use of mass media is possibly due to the commercialization of mass media which according to Arokoyo (1998) compels extension services to pay exorbitantly for air time and the printing charges. Conversely, Yahaya (2002) explained that, trends in Nigeria's agricultural development scenario show that mass media have tremendous potentials for agricultural information

dissemination. In other studies, Bouare and Bowen (1990) found that extension agents in Ohio thought the most important delivery methods were office visits, telephone calls, bulletins and newsletters. On the other hand, it has been reported that individual farmer approaches have been slow and have not resulted in better farm management (Thomas et al., 1997).

Majority (72.4%) of the extension officers frequently used field days as a method of communicating to farmers on soil fertility management. However, 46.6% of the respondents had frequently used demonstration while only 1% had not used demonstration as a method of communicating on soil fertility management practices. Among the respondents who were interviewed 72.9% and 72.6% had not used video documentaries or TV/radio, respectively. It is also important to note that 47.6% of the extension agents had also used FFS as extension method in training on animal manure (Table 4.16).

**Table 4.16:** Extension methods used by extension agents in Maara, Meru South, Mbeere South and Embu districts

| Communication method | Respondents (%) | | | |
|---|---|---|---|---|
| | Very frequently | Frequently | Rare | Never |
| Demonstration N=103 | 46.6 | 48.5 | 3.9 | 1.0 |
| Field days N=105 | 17.1 | 72.4 | 8.6 | 1.9 |
| Leaflet /brochures N=96 | 3.1 | 26.0 | 51.0 | 19.8 |
| Video documentaries N=96 | 2.1 | 0 | 25.0 | 72.9 |
| Exchange visits N=96 | 5.2 | 28.1 | 52.1 | 14.6 |
| Lecture method N=100 | 22.0 | 34.0 | 33.0 | 11.0 |
| Mother baby N=96 | 9.4 | 44.8 | 28.1 | 17.7 |
| Farmer field school N=100 | 9.7 | 47.6 | 34.0 | 8.7 |
| TV /radio n=95 | 0 | 7.4 | 20.0 | 72.6 |
| Agricultural shows N=99 | 6.1 | 25.3 | 62.6 | 6.1 |
| Magazines/books N=98 | 3.1 | 8.2 | 55.1 | 33.7 |

The low use of TV/radio and video documentaries could be attributed to the fact that a lot of resources are required during the process. The results indicate that extension agents use different extension methods to train farmers on soil fertility management. This comply with the findings of Asiabaka (2002) who reported that an extension campaign that utilizes several different methodologies of information dissemination (e.g., radio messages, demonstration, banners, posters, and bulletin boards) will be more effective than relying solely on one-to-one visits.

### 4.2.3 Effectiveness of extension methods as perceived by extension agents

Extension agents perceived demonstration method as the most effective method overall (mean rank of 3.6 out of 4) while field days followed closely with a mean score of 3.3. Farmer field school ranked third ($3^{rd}$) overall with a computed mean of (3.1) but second in the teaching of green manure and soil erosion control (Table 4.17). This agrees with Farouque and Takeya (2009) findings that demonstrations and farmer field schools are particularly effective when the majority of the client group is resource poor and illiterate, as such they have a tendency to avoid risk. Ford (1995) found that farm visits, demonstrations, and field days were the most effective methods used by extension agents to disseminate information in West Tennessee.

**Table 4.17**: Effectiveness of extension methods as scored by extension agents in Maara, Meru South, Mbeere South and Embu districts

| | **SFM PRACTICE** | | | | | | |
|---|---|---|---|---|---|---|---|
| **Extension method** | **Animal Manure** | **Compost** | **Green Manure** | **Inorganic fertilizers** | **Combination of manure and fertilizer** | **Soil erosion control measures** | **Average** |
| Demonstration | 3.9 | 3.7 | 3.3 | 3.7 | 3.8 | 3.7 | 3.7 |
| Field days | 3.5 | 3.3 | 2.7 | 3.7 | 3.6 | 3.5 | 3.4 |
| FFS | 3.3 | 3.3 | 2.9 | 3.3 | 3.3 | 3.1 | 3.2 |
| Farmer to farmer | 3 | 3 | 2.7 | 3 | 3.2 | 3 | 3.0 |
| Exchange visit | 2.9 | 2.8 | 2.6 | 2.7 | 2.9 | 2.9 | 2.8 |
| Mother baby | 2.8 | 2.7 | 2.7 | 2.9 | 2.8 | 2.8 | 2.8 |
| Workshops | 2.6 | 2.5 | 2.3 | 2.6 | 2.6 | 2.7 | 2.6 |
| Print media | 2.1 | 2.1 | 2 | 2.1 | 2.1 | 2.1 | 2.1 |
| Radio/TV | 2.1 | 2 | 1.9 | 2.1 | 2 | 2 | 2.0 |
| Video Showing | 1.9 | 1.9 | 1.9 | 1.9 | 1.9 | 2 | 1.9 |

N=105 Scale used; 1=Not effective, 2=least effective, 3= moderately effective, 4=Effective

### 4.2.4 Accessible sources of information on soil fertility management practices by extension agents

Research institutions were the overall most accessible source of information on soil fertility management practices by extension agents with a mean of 2.6 (Table 4.18). This implies that more interaction between researchers and extension should be encouraged.

**Table 4.18:** Accessible information source by the extension agents in Maara, Meru South, Mbeere South and Embu districts

| Source of information | Animal manure | Compost | Green manure | Fertilizer | Combination Fertilizer &manure | SEM | Mean |
|---|---|---|---|---|---|---|---|
| Research institution | 2.5 | 2.6 | 2.5 | 2.8 | 2.7 | 2.7 | 2.6 |
| Books | 2.4 | 2.5 | 2.5 | 2.7 | 2.6 | 2.8 | 2.6 |
| Workshops | 2.4 | 2.5 | 2.3 | 2.5 | 2.5 | 2.5 | 2.5 |
| Radio/TV | 2.1 | 2.1 | 2.1 | 2.3 | 2.1 | 2.1 | 2.1 |
| Newsletters/brochure | 2.1 | 2.1 | 2.0 | 2.2 | 2.2 | 2.2 | 2.1 |
| Agro input dealers | 1.9 | 1.9 | 1.8 | 2.8 | 2.4 | 1.9 | 2.1 |
| NGO | 1.9 | 2 | 1.9 | 1.9 | 2 | 2.1 | 2 |
| Internet | 1.6 | 1.6 | 1.6 | 1.7 | 1.6 | 1.7 | 1.6 |
| Scientific conferences | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 |

N=105

Scale used; 1=not accessible, 2=Least accessible, 3=fairly accessible, 4=Accessible

However, books scored 2.6 while workshops /seminars were ranked 3rd in accessibility of information with a mean of 2.5 (Table 4.18). These results also suggest that Kenya Agricultural Research Institute located at Embu has been beneficial in provision of information on soil fertility management to extension agents. However, Garforth (1998) recommended that workshop are also very effective means of encouraging uptake of research output by intermediate user who can also be engaged in dissemination process.

Internet and scientific conferences were least scored as accessible sources of SFM information by extension agents with mean score of 1.64 and 1.42, respectively (Table 4.18). The possible reason for the low scoring of the latter would be because few extension agents are computer literate and the former would be because scientific conferences are mainly held in the highest institution of learning or research institutions. This also implies that most of the information published in scientific journals and subscribed online is not accessed by the extension agents. The research finding agrees with Maddox et al. (2003) who found that nearly half of the extension agents in North Carolina never used internet. Ngathou et al. (2006) also found that although internet is not used by masses, certain groups appreciated internet based information.

### 4.2.5 Involvement of stakeholders

Responding to decline in soil fertility in the region requires multiple stakeholders to participate and plan for changing conditions and uncertainty. Majority (76% and 75%) of the extension officers involved the Ministry of Agriculture and farmers respectively during their field days (Table 4.19). About 32% of the extension officers involved researchers during their field days while only 30% involved them during demonstration.

**Table 4. 19**: Involvement of stakeholders in different activities by extension agents in Maara, Meru South, Mbeere South and Embu districts

| Stakeholders | Field day | Demonstration | Workshop | Farmer field school | Excursion |
|---|---|---|---|---|---|
| Other extension agents from MOA | 80(76) | 71(68) | 46(44) | 46(44) | 37(35) |
| Farmers | 79(75) | 71(68) | 26(25) | 43(41) | 38(36) |
| Provincial administration | 62(59) | 31(30) | 5(5) | 13(12) | 12(11) |
| NGOs | 51(49) | 25(24) | 13(12) | 13(12) | 10(10) |
| Agro input dealers | 51(49) | 21(20) | 12(11) | 3(3) | 6(6) |
| Researchers | 34(32) | 31(30) | 13(12) | 5(5) | 6(6) |

N.B: Numbers in parentheses give the percentage of respondents
N=105

Only 5% of the extension officers involved provincial administration during the workshops and 3% involved agro input dealers during farmer field school (Table 4.19). The general conclusion that could be made from the observation is that the main stakeholders involved during promotion of SFM practices are mainly the other extension agents from the Ministry of Agriculture (MOA), researchers and farmers. For widespread SFM dissemination and scaling- up, there is need to invest in broad partnerships, including farmers' organizations and service providers such as agro dealers, extension, Community based organizations (CBOs) and local NGOs for farmer mobilization, capacity building and linking farmers to credit and markets (Spielman et al., 2007).

### 4.2.6 Constraints that hinder effective dissemination of SFM practices as perceived by the extension agents

Little participation of extension officers during research innovation was mentioned as the most critical challenge by 48%, while lack of basic infrastructure e.g. computers was mentioned to be most critical by 49% of the extension agents. Lack of adequate time was considered as most critical by only 12.7% of the extension agent (Table 4.20).

**Table 4.20:** Constraints that hinder effective dissemination of SFM practices as perceived by the extension agents in Maara, Meru South, Mbeere South and Embu districts

| Constraints | Not critical | Least critical | Moderately critical | Most Critical | Mean Scores |
|---|---|---|---|---|---|
| Little Participation on research innovation | 3(2.9) | 15(14.7) | 35(34.3) | 49(48.0) | 3.27 |
| Lack of basic infrastructure e.g. computers | 9(8.8) | 13(12.7) | 30(29.4) | 50(49.0) | 3.19 |
| Inadequate resource materials | 6(5.9) | 9(8.8) | 49(48.0) | 38(37.3) | 3.17 |
| No opportunity to attend short term courses | 4(3.9) | 24(23.5) | 32(31.4) | 42(41.2) | 3.10 |
| Ineffective policies | 10(9.8) | 13(12.7) | 46(45.1) | 33(32.4) | 3.00 |
| Poor networking Among stakeholders | 5(4.9) | 22(21.6) | 45(44.1) | 30(29.4) | 2.98 |
| Low level of education of target Groups | 7(6.9) | 34(33.3) | 41(40.2) | 20(19.6) | 2.73 |
| Inadequate communication skills | 19(18.6) | 27(26.5) | 40(39.2) | 16(15.7) | 2.52 |
| Limited time available | 15(14.7) | 34(33.3) | 40(39.2) | 13(12.7) | 2.50 |

N.B: Numbers in parentheses are the percentage of respondents

N=102

These findings agrees with the findings of Arnon (1987) that field level extension service providers are inadequately involved in research innovations, consequently, extension agents do not have the chance to express their opinions about new technology based on the existing farmers needs. Participation of the extension agents in the research process would ensure local ownership and adaptive capacity is developed. The participation of extension workers in adaptive research trials allows them to become familiar with the technologies they are expected to promote and also helps to ensure that the sociological dimensions of farming are not neglected (Agbamu, 2000).

## 4.3 Researchers

### 4.3.1 Social demographic characteristics of the researchers

The mean age of the researchers interviewed was 47 years. Most (50%) of the researchers ranged between 41-50 years of age while 31.4% were between 51-60 years. About 90.9% of the researchers interviewed were males while only 9.1% were females. Overall, 54.5% of the researchers had an experience of more than 15 years while 22.7% had less than 5 years experience in research. A higher percentage (45.5%) of the researchers had acquired masters' degree while 18.4% had reached Degree of Doctor of Philosophy (Ph D) level (Table 4.21).

**Table 4.21:** Social demographic characteristics of the researchers who had participated in SFM research in Meru South, Mbeere South, Embu and Maara districts in Central Kenya

| **Gender** | **Frequency** | **Percent (%)** |
|---|---|---|
| Male | 20 | 90.9 |
| Female | 2 | 9.1 |
| Total | 22 | 100.0 |
| **Age** | | |
| 25-40 years | 4 | 18.2 |
| 41-50 years | 11 | 50 |
| 51-60 years | 7 | 31.8 |
| Total | 22 | 100 |
| **Education** | | |
| Certificate | 2 | 9.1 |
| Diploma | 3 | 13.6 |
| Bachelors degree | 3 | 13.6 |
| Masters degree | 10 | 45.5 |
| Ph D | 4 | 18.2 |
| Total | 22 | 100.0 |
| **Years of research** | | |
| Less than 5 years | 5 | 22.7 |
| 5-10 years | 5 | 22.7 |
| More than 15 years | 12 | 54.5 |
| Total | 22 | 100.0 |

N.B: Numbers in parentheses give the percentage of respondents

N=22

The results imply that most of the extension researchers are middle aged, well educated and have amassed experience in their areas of specialization on soil fertility management. This indicates that the researchers would be well aware of the various extension methods used in dissemination of soil fertility management practices.

### 4.3.2 Extension methods and approaches used by researchers in dissemination of soil fertility management

The most commonly used extension method by researchers in dissemination of all the technologies was demonstration except for combined organic and inorganic where 88.2% of the researchers commonly used field days. However, field days were the second most used method by 88.2%, 82.4%, 66.7%, and 71.4% in dissemination of mineral fertilizers, animal manure, green manure, and compost, respectively (Table 4.22). About 61.5% used farmer field school in dissemination of combined organic and inorganic fertilizers. Exchange visits were also used by 69.2% and 61.5% in dissemination of mineral fertilizers and animal manure, respectively. Video showing and radio/TV were the least commonly used in dissemination of soil fertility management practices (Table 4.22).

**Table 4.22** Extension methods used by researchers in dissemination of soil fertility technologies in Meru South, Mbeere South, Embu and Maara districts in Central Kenya

| Extension method | Mineral fertilizers | Animal manure | Green manure | Compost | Combined organic &inorganic | Erosion control measures |
|---|---|---|---|---|---|---|
| Demonstration | 16 (88.9) | 16 (84.2) | 12 (70.6) | 11 (73.3) | 15 (83.3) | 11 (73.3) |
| Workshop | 7 (53.8) | 8 (57.1) | 9 (60) | 5 (41.7) | 8 (61.5) | 5 (50) |
| Field days | 15 (88.2) | 14 (82.4) | 10 (66.7) | 10 (71.4) | 15 (88.2) | 9 (64.3) |
| Farmer to farmer extension | 7 (58.3) | 7 (58.3) | 7 (58.3) | 5 (45.5) | 7 (58.3) | 5 (50) |
| Video showing | 2 (22.2) | 2 (22.2) | 2 (22.2) | 3 (30) | 2 (22.2) | 4 (44.4) |
| Radio/TV | 1 (12.5) | 1 (12.5) | 1 (12.5) | 0 (0) | 1 (12.5) | 1 (14.3) |
| Farmer field school | 7 (53.8) | 8 (57.1) | 6 (50) | 5 (45.5) | 8 (61.5) | 5 (55.6) |
| Print media | 5 (45.5) | 5 (45.5) | 4 (40) | 4 (36.4) | 5 (45.5) | 4 (40) |
| Exchange visit | 9 (69.2) | 8 (61.5) | 7 (58.3) | 4 (40) | 9 (69.2) | 5 (50) |

N.B: Numbers in parentheses give the percentage of respondents

The results indicate that most of the researchers use different delivery methods in teaching on soil fertility management practices. These findings agree with Boldt (1987), who stated that varied extension methods should be used to deliver information to reach a more diverse audience.

### 4.3.3 Mass media used by researchers to communicate to smallholder farmers and extension workers

Posters were the most often used (61%) print media by the researchers to communicate to the farmers while manuals (57.1%) were the most often used to communicate to the extension agents (Table 4.23). None of the researchers used journals to communicate to the farmers, however 27.3% had often used journals to communicate to the extension officers. At least 30.8% of the researchers most often used books to communicate to the extension agents. Brochures and reports had most often been used to communicate to the extension agents by 46.2% of the researchers. The results agrees with the findings that posters were the most commonly read media by the farmers as indicated in section 4.1.6 of the thesis since they were the most often used by researchers.

**Table 4.23:** Mass media used by researchers to communicate to smallholder farmers and extension workers on soil fertility management in Meru South, Mbeere South, Embu and Maara districts in Central Kenya

| | Smallholder farmers | | | | | Extension officers | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Mass media** | **N** | **Most often%** | **Often used%** | **Rarely used%** | **Not used at all%** | **N** | **Most often%** | **Often used%** | **Rarely used%** | **Not used at all%** |
| Reports | 12 | 25.0 | 8.3 | 16.7 | 50.0 | 13 | 46.2 | 30.8 | 15.4 | 7.7 |
| Journals | 11 | 0 | 0 | 0 | 100.0 | 11 | 0 | 27.3 | 45.5 | 27.3 |
| Magazines | 11 | 9.1 | 9.1 | 18.2 | 63.6 | 11 | 36.4 | 36.4 | 18.2 | 9.1 |
| Newsletters | 12 | 0 | 41.7 | 25.0 | 33.3 | 12 | 33.3 | 50.0 | 8.3 | 8.3 |
| Posters | 13 | 61.5 | 30.8 | 7.7 | 0 | 12 | 33.3 | 50.0 | 8.3 | 8.3 |
| Manuals | 13 | 7.7 | 30.8 | 30.8 | 30.8 | 14 | 57.1 | 35.7 | 7.1 | 0 |
| Books | 10 | 0 | 10.0 | 20.0 | 70.0 | 13 | 30.8 | 38.5 | 15.4 | 15.4 |
| Brochures | 15 | 46.7 | 26.7 | 13.3 | 13.3 | 15 | 46.7 | 40.0 | 6.7 | 6.7 |
| Radio | 11 | 0 | 9.09 | 9.09 | 81.8 | 10 | 0 | 0 | 20.0 | 80.0 |
| Website | 9 | 0 | 0 | 0 | 100 | 10 | 0 | 20.0 | 40.0 | 40.0 |

None (0%) of the researchers used website to communicate to the farmers, while 40% often used website to communicate to the extension agents (Table 4.23). This was probably because of the low level of computer literacy among the farmers and lack of computers in agricultural offices. However, Annerose (2003) in her study in Senegal reported that internet and electronic publications can be new source information for farmers in Senegal. In another study (Anderson, 2008) reported that the incidence of limited use of electronic mass media can further limit the ability to reach clients via means that do not require face-to-face interaction (e.g., written materials, radio, television, Internet).

### 4.3.4 General constraints that impede successful dissemination of SFM as perceived by researchers

Majority of the researchers (60%) indicated that lack of adequate resource materials was most critical constraint in dissemination of SFM practices while poor networking among stakeholders was perceived as most critical by 50% of the researchers (Table 4.24). About 50% of the researcher mentioned that low level of education was moderately critical in hindrance of information transfer (Table 4.24). However, according to Kamau et al. (2002) illiteracy has had a negative implication on awareness, access and adoption of technology. Illiterate farmers are unlikely to take initiative in venturing into new grounds.

**Table 4. 24:** General constraints that impede successful dissemination of SFM as perceived by researchers in Meru South, Mbeere South, Embu and Maara districts in Central Kenya

| | Percent (%) Respondents | | | | |
|---|---|---|---|---|---|
| **Constraint** | **Not critical** | **Least critical** | **Moderately critical** | **Most critical** | **Mean** |
| Inadequate resource materials | 0 | 10 | 30 | 60 | 3.5 |
| Poor net working among stakeholders | 0 | 10 | 40 | 50 | 3.4 |
| Little participation of stakeholders on research innovation | 0 | 15.8 | 47.3 | 36.8 | 3.2 |
| Ineffective policies | 5 | 20 | 45 | 30 | 3 |
| No opportunity to attend short term courses on communication skills | 0 | 35 | 30 | 35 | 3 |
| Limited time available | 5 | 25 | 40 | 30 | 2.9 |
| Inadequate communication skills | 10 | 15 | 50 | 25 | 2.9 |
| Lack of basic infrastructures e.g. computer | 15 | 5 | 65 | 15 | 2.8 |
| Low level of education of target groups | 10 | 30 | 50 | 10 | 2.6 |

**N=22**

# CHAPTER FIVE

# 5.0 CONCLUSIONS AND RECOMMENDATIONS

## 5.1 Conclusions

The first objective of this study was to assess the availability and reliability of information sources utilized by farmers to improve soil fertility on their farms. Farmers perceived other farmers as the most available source of information on soil fertility management followed by radio, government extension workers, exhibition/shows and researchers. In addition, farmers' reliability on other farmers was very high followed by government extension agents, agricultural researchers and radio, respectively. These results point to the need for the researchers and extension agents to increase their interaction with farmers as they are perceived to be the most available and most reliable sources of information.

The second objective was to determine the extension methods used by researchers and extension agents in dissemination and up scaling of soil fertility management practices. Demonstration and farmer to farmer extension methods were the most commonly used methods to train farmers on animal manure, inorganic fertilizers, and green manure, compost and soil erosion control measures. Demonstration, farmer to farmer extension and workshops/seminar were ranked as the first three methods preferred by the farmers, respectively. Majority of the researchers and extension officers frequently used field days and demonstration as methods of communicating to farmers on soil fertility management. Demonstration was highly preferred by the farmers as well as considered effective by the extension agents and researchers thus it would be the most appropriate method in dissemination of soil fertility management practices

The third objective was to determine the influence of socio-economic characteristics on farmers' preference of communication methods used in dissemination of soil fertility management practices. According to the results, preference of demonstration by farmers in training on green manure was positively influenced by age and number of non formal trainings but negatively influenced by farm size and gender. In training on fertilizers, preference of workshop as an extension method was positively influenced by age, gender and farm size but negatively influenced by years of experience. Logistic regression analysis showed that gender, education, number of non formal trainings attended, farm size, number of groups that a farmer belongs and number of times a farmer had been visited by an extension agent were significant predictors in preference of field days in training of animal manure. These factors should therefore be considered in selection of field day as an extension method in promotion of animal manure. The results also imply that the choice of extension method will depend on the nature of the SFM practice and the characteristics of the potential users. These underscore the importance of the farmers' socio- economic factors in designing extension intervention strategies.

### 5.2 Recommendations

Based on findings of this study area, the following recommendations should be considered:

- Research projects should allocate funds to facilitate extension delivery services such as farmer to farmer extension in order to encourage more active participation of farmers in dissemination of soil fertility management practices

- Researchers and extension agents should consider more use of demonstration as it is the most preferred method by the farmers as well as considered effective by the extension agents

- Researchers and extension agents are also encouraged to consider farmers' socio-economic characteristics in designing extension intervention strategies in dissemination of different soil fertility management practices

### 5.3 Further research

Further studies are recommended in these areas:

- Assessment of the cost-effectiveness of dissemination methods used by researchers and extension agents. This will provide more guidance to agricultural stakeholders in selection of communication channels, hence improve delivery of soil fertility management research findings to the farmers who are the end users
- Competencies of extension agents and researchers in all the extension delivery methods

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## APPENDICES

### APPENDIX 1

### FARMER INTERVIEW SCHEDULE

A Household Number

**Questions are addressed to the household head/farm decision maker who should preferably be the respondent.**

**Enumerator's Name:** _____ Date of interview____/_____/ 2010

Time the interview started ____ : ____

| **Core var. no** | **Variable label** | ***Variable values and rules*** |
|---|---|---|
| | Household Demographic and Socio-Economic Characteristics | |
| 1 | District __ __ | |
| 2 | Division | |
| 3 | Location | |
| 4 | Sub-Location and village | |
| 5 | Name of the household head_ | |
| 6 | Respondent ____ | *1=Household head, 2= spouse of the household head, 3=grown up child, 4= relative, 5= other (specify)* |
| 7 | Household type | *1= Nuclear, 2= Extended, 3= Polygamous, 4= female headed (widow, never married, divorced), 5= male headed), 6= Not yet married males* |
| 8 | Gender of household head (Decision maker of farm operations) | *1=Male2= female* |
| 9 | Age of household head ____ years | |
| 10 | Educational level of Household Head? | *1=no education, 2=primary education, 3=secondary education, 4=tertiary education (Specify)* |
| 11 | How many years of farming experience_____ | *1=less than 10 years, 2=11-20 years,3=Above 20 years* |
| 12 | Approximately how many non formal trainings have you attended since you started farming?_____ | *1=None 2=1-5 times 3=6-10 times 4=more than 10 times* |
| 13 | Household size _____ | |

| | | |
|---|---|---|
| 14 | Occupation of Household head_____ | *1=Farming,2=Business,3=Employed* |
| 15 | Occupation of the spouse_____ | *1=Farming,2=Business,3=Employed* |
| 16 | How many household members are working on the farm?__ | |
| 18 | Why do you do farming? | *1=for food 2=for income 3= for both income and food* |
| 19 | Approximately how much income do you earn from your farm in a season? | *1=0-5,000Ksh 2=5,001-10,000Ksh 3=10,000-15,000Ksh 4=15,000Ksh and above* |
| 20 | How can you describe the status of this household in terms of wealth(Enumerator to do judgment)_____ | *1=Rich, 2=Middle, 3= poor* |
| 21 | Are you currently a member of any farmers' group or local association in this village? | *1=yes 2=No Indicate the code* |
| 22 | Number of the groups that you are a member_____<br>Activities -1st group_____<br>2nd group_____<br>3rd group_____<br>Others_____ | *If yes, indicate the number of groups below and activities of the group*<br>*1=Merry-go round,2=Savings and credit*<br>*3=Agricultural related activities, 4=Marketing,5= Other(specify)* |
| 23 | What is your total farm size? | ____acres |
| 24 | How much of your land is cultivated? | ____acres |
| 25 | How much of your land is idle | ____acres |
| 26 | How much of your land is under pasture? | ____acres |
| 27 | Do you hold a formal title or registration of the whole or parts of your land? | *1=yes 2= no* |
| 28 | How would you generally rate the fertility status of your farm?_____ | *1=High, 2 = Low, 3=Does not know* |
| 29 | What proportion of your farm is | *Indicate the code 1 = 0% ,2 = 25%, 3 = 50%, 4 = 75% 5 = 100%* |
| | i)Fertile _____ | |
| | ii)Medium fertility _____ | |
| | iii)Poor fertility _____ | |
| 30 | Based on the following practices, how do you try to improve soil productivity? | *Check all what you practice [ √ ] then indicate the source of information from the options below*<br>*1= government extension worker, 2=NGO extension worker, 3=Researchers 4=Agro-input dealers,5=Radio/TV,6= print media, 7 = Exhibition/show 8 = Other farmers,9=Your own experience* |
| | i)Animal manure [ ] | |
| | ii)Green manure(specify) [ ] _____ | |
| | iii)Application of inorganic fertilizer [ ] | |
| | iv)Combined organic fertilizers and inorganic fertilizers [ ] | |
| | v)Erosion control measures [ ] | |
| | Vi)Compost [ ] _ | |
| | x)Other (Specify) [ ] | |
| 31 | Which method was used to train you on the following SFM practices? | *Check all that apply* [ √ ]<br>The following options are to be used |

| | | |
|---|---|---|
| | i)Animal manure [ ]<br>ii)Green manure(specify) [ ] _____<br>iii)Application of inorganic fertilizer [ ]<br>iv)Combined organic fertilizers and inorganic fertilizers [ ]<br>vi)Erosion control measures [ ]<br>v)Compost [ ] _____<br>x)Other (Specify | on the "method of training "*1= Demonstration ,*<br>*2=Exchange visit,*<br>*3=Field days*<br>*4=Farmer field school*<br>*5=Workshop/seminar*<br>*6=farmer to farmer extension*<br>*7=Others (specify)* |
| 32 | How many times have you attended or participated in the following activities?<br>Farmer field school --<br>Exchange visit -----<br>Demonstration -----<br>Workshop/Seminar -----<br>Field days -----<br>Others(specify ----- | *Indicate the number of times. Where there is none indicate 0* |
| 33 | Will you understand the following languages if they are used to train you on soil fertility practices?<br>i)English _____<br>ii)Kiswahili _____<br>iii)Vernacular(Specify) _____ | *State 1= yes 2=No* |
| 34 | What is your attitude towards researchers? | *1=favourable, 2=Neutral, 3= unfavorable* |
| 35 | Have you ever visited research station on soil fertility related matters?<br>_____ | *State 1= yes 2=No* |
| 36 | From your experience, how available are the following sources of SFM practices?<br>Government extension worker ----<br>NGO extension worker ----<br>Researchers ----<br>Agro-input dealers ----<br>Print media ----<br>Exhibition/Shows ----<br>Radio/TV ----<br>Other farmers ----<br>Others(specify) ---- | *Options on availability*<br>*4=most available*<br>*3=available,*<br>*2=least available*<br>*1=Never available* |

| | | |
|---|---|---|
| 37 | From the below List of challenges that hinder communication of SFM information. *Score the challenges according to how critical they are*<br>a)Not practical oriented --<br>---<br>b)Repetition of the information --<br>---<br>c)Inadequate literature materials --<br>---<br>d)Information is not related to their problems --<br>---<br>e)No individual follow up by extension workers --<br>---<br>f)Lack of discussion groups for farmers --<br>---<br>g)Low literacy among farmers --<br>---<br>h)Poor attitude towards extension workers --<br>---<br>i)Resource constraints --<br>---<br>j)Very sophisticated terms are used during trainings --<br>---<br>k)Others (specify) --<br>-- | *Use the options*<br>*1=Not serious*<br>*2=Least serious*<br>*3=Moderately Serious*<br>*4=Very serious* |
| 38 | Do you have the following appliances? A)RadioB)TV | *State yes or No 1=Yes 2=No* |
| 39 | Through which Radio/TV programmes have you gained knowledge on soil fertility practices?<br>Station Programme SFM practice | *List the station and the Programmes* |
| 40 | Have you ever been visited by an agricultural officer?_____ | *1=yes,*<br>*2=No* |

| | | |
|---|---|---|
| 41 | What attributes do you associate with people who know how to communicate well with farmers on SFM practices?<br>A)The person who is jovial<br>B)The person who demonstrates<br>C)The person who uses teaching aids -<br>D)The person who listens to farmers needs and responds-<br>E)The person who uses simple terms to express his views -<br>F)The person who is motivating -<br>G)The person who gives real life example -<br>H)The person who uses locally available resources to train -<br>I)The person who encourages farmers' participation<br>J)Others (specify) - | *Use options*<br>*1=Not important,*<br>*2=Fairy important*<br>*3=Important*<br>*4=Very Important* |
| 42 | If yes, indicate the number of times _____ | *Indicate the number of times* |
| 43 | What is your attitude towards extension workers? ---- | *1=favourable, 2=Neutral ,3= unfavourable* |

44.For the different types of SFM practices Score the level of preference of the different communication methods used in training farmers *Use the scores 1=Not preferred, 2=Least preferred, 3=Fairy preferred, 4=Most Preferred*

| **Communication Method** | **Animal manure** | **Green manure (Specify)** | **Fertilizer** | **Compost** | **Combined fertilizer and manure** | **Soil erosion measures** |
|---|---|---|---|---|---|---|
| Field days | | | | | | |
| Farmer field school | | | | | | |
| Demonstrations | | | | | | |
| Use of teaching aids | | | | | | |
| Exchange visits | | | | | | |
| Workshops/seminars | | | | | | |
| Farmer to farmer extension | | | | | | |
| Others (specify) | | | | | | |

45. Which of the following approaches do you prefer in the training of SFM practices?
1= Do not prefer 2=mildly prefer 3=strongly prefer

| **Approach** | **Score level of preference** | | |
|---|---|---|---|
| | Do not prefer | Mildly prefer | Strongly prefer |
| Individual farmer interaction | | | |

| | | | |
|---|---|---|---|
| Group approach | | | |
| Mass media | | | |

46. According to your experiences, score the reliability of the different sources of information on soil fertility management practices .*Use the options 1= Not reliable 2=Least reliable, 3=Moderately reliable, 4= Most reliable*

| **Source of information** | **Animal manure** | **Green manure (Specify)** | **Fertilizer** | **Compost** | **Combined fertilizer and manure** | **Soil erosion measures** |
|---|---|---|---|---|---|---|
| Government extension officers | | | | | | |
| NGOs | | | | | | |
| Agricultural researchers | | | | | | |
| Input Stockists | | | | | | |
| Other farmers | | | | | | |
| Print media | | | | | | |
| Radio/TV | | | | | | |
| Exhibitions/shows | | | | | | |
| Others (specify) | | | | | | |

47) Which of the following print media have you read to create your awareness on the following SFM practices?

| **Print media** | **Animal manure** | **Green manure (Specify)** | **Fertilizer** | **Compost** | **Combined fertilizer and manure** | **Soil erosion Measures** |
|---|---|---|---|---|---|---|
| Posters | | | | | | |
| Brochures | | | | | | |
| Magazines | | | | | | |
| Newspapers | | | | | | |
| Newsletters | | | | | | |
| Manuals | | | | | | |
| Others (specify) | | | | | | |

48. What do you suggest should be done to improve on dissemination (communication or spreading out) of soil fertility practices?

1.

2

**APPENDIX 2**

QUESTIONNAIRE FOR RESEARCHERS

**Enhancing communication for effective up scaling of soil fertility management technologies**

**Personal Information**

1Full name ---------- 1=Male --2= Female--

Name of your Institution ----------

Education qualification1=Certificate____,2=Diploma___, 3=Bachelors degree_____,_ 4=Masters degree_____ 5= PHD ____6=Above_____ ,

Telephone----------

Email----------

Age----------

2. Which are your key areas of responsibility? *Circle the option*1 =on- farm research, 2 =On station research 3 =Lab work 4. =Administration 5=Lecturer 6=others (specify)

3. Indicate the total number of years of research experience related to agriculture

| **Duration** | **Tick appropriately** |
|---|---|
| 1=Less than 5 years | |
| 2=5-10 Years | |
| 3=10-15Years | |
| 4=More than 15 years | |

4. Which is/are your area(s) of specialization in soil fertility management practices?

| **Specialization** | **Tick appropriately** |
|---|---|
| 1= organic Fertilizers | |
| 2=Inorganic Fertilizers | |
| 3=Soil conservation | |
| 4=Soil water | |
| 5=Soil health | |
| 6=Others (specify) | |

5. Please give us the following information about your research study for the last five years

| **Year of Research** | **Project Name** | **Aim of research** | **District** | **Location** | **Methods & tools used in dissemination** |
|---|---|---|---|---|---|
| | | | | | |

6. Which of the following soil fertility management technologies have you trained farmers on? Indicate the method used to train farmers. *Tick appropriately*

| Extension method | Mineral fertilizers | Animal manure | Green manure | Compost | Combined organic &inorganic | Erosion control measures |
|---|---|---|---|---|---|---|
| Demonstration | | | | | | |
| Workshop | | | | | | |
| Field days | | | | | | |
| Farmer to farmer extension | | | | | | |
| Video showing | | | | | | |
| Radio/TV | | | | | | |
| Farmer field school | | | | | | |
| Print media | | | | | | |
| Exchange visit | | | | | | |

7. To what extent have you used the following approaches in communication of SFM practices? *Use the following options. 1= Not used at all, 2=commonly used, 3= most commonly used*

| Approach | Score appropriately |
|---|---|
| Group method approach | |
| Individual contact approach | |
| Mass media approach | |

8. In you own perception Score the effectiveness of the following approaches for dissemination of the different SFM practices, research findings. *Use the options 1=Not effective 2= Least effective 3=Moderately effective 4 = effective 5= Very effective*

| Extension method | Mineral fertilizers | Animal manure | Green manure | Compost | Combined organic &inorganic | Erosion control measures |
|---|---|---|---|---|---|---|
| Demonstration | | | | | | |
| Workshop | | | | | | |
| Field days | | | | | | |
| Farmer to farmer extension | | | | | | |
| Video showing | | | | | | |
| Radio/TV | | | | | | |
| Farmer field school | | | | | | |
| Print media | | | | | | |
| Exchange visit | | | | | | |

9. Which languages do you use in communication of research findings*? (Tick)*
1= Kiswahili ___ 2=English _____3=Vernacular (Specify)_____

10. Have you been invited to any stakeholders forums?
1=Yes ---2=No-----
11. Have you involved other stakeholders in your activities? 1=Yes ____ 2=No_____
12. If yes, indicate for the last activity you held of its kind, who are the stakeholders involved *Tick appropriately.*

| **Activity** | **Field day** | **Demonstration** | **Workshops** | **FFS** | **Excursion** |
|---|---|---|---|---|---|
| Ministry of agriculture | | | | | |
| Other Researchers | | | | | |
| Farmers | | | | | |
| Provincial administration | | | | | |
| Agro input dealers | | | | | |
| NGOs | | | | | |

13. How do you communicate relevant information on SFM to other stakeholders? *Use the options 1=Most often used 2=Often used 3=Rarely used 4=Not used at all*

| **Stakeholder** | **Smallholder farmers** | **Extension agents** |
|---|---|---|
| Reports | | |
| Journals | | |
| Magazines | | |
| News letters | | |
| Poster | | |
| Manuals | | |
| Books | | |
| Brochures | | |
| Radio | | |
| Website/Internet | | |

14. How would you rate communication level between researchers and farmers on SFM?
*Tick the option, , 1=poor, 2= Fair, 3=Good, 4=excellent*

| Poor | Fair | Good | *Excellent* |
|---|---|---|---|
| | | | |

15 How would you rate communication level between extension personnel and researchers on SFM?
*Tick the option, 1=poor, 2= Fair, 3=Good, 4=excellent*

| Poor | Fair | Good | *Excellent* |
|---|---|---|---|
| | | | |

16.From the below list of the general constraints which impede success of dissemination and knowledge sharing of SFM research findings among agricultural stakeholders, *use the options given to Score the severity of the problem*
*1=not critical, 2=Least critical, 3=Moderately critical, 4= Most critical*

| **Constraints** | **Score** |
|---|---|
| Lack of basic infrastructures e.g. computer | |
| Limited time available | |
| Inadequate communication skills | |
| Ineffective policies | |
| Inadequate resource materials | |
| No opportunity to attend short term courses on training skills | |
| Little participation of stakeholders on research innovation | |
| Poor net working among stakeholders | |
| Low level of education of target groups | |
| Others (specify) | |

17. What do you think should be done for effective dissemination and knowledge sharing of SFM research findings?

**THANK YOU**

**APPENDIX 3**

QUESTIONNAIRE FOR EXTENSION OFFICERS

**Enhancing Communication for Effective Up-Scaling of Soil Fertility Management Technologies**

**1a. Personal Information**

Full Name _____

Gender 1=Male 2= Female_____

Name of your organization _____

District_____Division_____

Education qualification;1= Certificate__ 2=Diploma__ 3=Higher Diploma__4= Degree__ 5=Masters _6=Others__

Telephone _____

Email _____

Age_____

1b.Which is your key area of responsibility? Circle the option

1=soil conservation, 2=Crops development, 3=Agribusiness, 4=Home Economics, 5=Farm planning, 6=Field extension work, 7= Others (specify)

1c. Total years of professional experience related to agriculture

| **Duration** | **Tick** |
|---|---|
| 1=Less than 5 Years | |
| 2=5 Years to 10 Years | |
| 3=10Years to 15 Years | |
| 4=More than 15 Years | |

3a. Do you follow up on the farmers that have been trained? *1=Yes 2= No___3=whenever possible*

If yes, how many times per season?

| **Number of times** | **Tick appropriately** |
|---|---|
| 1-2 times | |
| 3-4 times | |
| More than 4 times | |

3b.What are some of the challenges that hinder follow up of farmers? Score the challenges according to the level of severity.

*Where; 1=Not severe, 2=least severe, 3=moderately severe 4=Most severe,*

| **Reason** | **Score according to their severity** |
|---|---|
| Resource constraints | |
| Poor infrastructure | |
| Limited time | |
| Poor planning | |
| Others (specify) | |

4. How frequent do you use the following communication methods in training farmers? (Tick where appropriate)

| **Method of communication** | **Very frequent** | **Frequent** | **Rare** | **Never** |
|---|---|---|---|---|
| Demonstration | | | | |
| Field days | | | | |
| Leaflet /brochures | | | | |
| Video documentaries | | | | |
| Exchange visits | | | | |
| Lecture method | | | | |
| Mother baby | | | | |
| Farmer field school | | | | |
| TV /radio | | | | |
| Agricultural shows | | | | |
| Magazines/books | | | | |

5. Indicate the percentage of farmers in your area who usually attend the training

| **Percentage Range** | **Tick** |
|---|---|
| 1=20% | |
| 2=21-40% | |
| 3=41-60% | |
| 4=61-80% | |
| 5=81-100% | |

6. Which teaching aids do you use during the training of farmers? *Tick below*. How frequent? *1=Never, 2=rarely, 3=Often, 4=Very often*

| **Teaching Aid** | **Tick** | **Frequency** |
|---|---|---|
| Charts | | |
| Plays | | |
| Video | | |
| Exhibits | | |
| Others; Please specify | | |
| No teaching aid | | |

7. Which language do you use for communication purposes?(Tick)

1 = Kiswahili_____2 = English_____3 = Vernacular (specify)_____

8. To what extent have you used the following approaches in communication of SFM practices? *Use the following options. 1= Not used at all, 2=moderately used, 3= most commonly used*

| **Approach** | **Score appropriately** |
|---|---|
| Group method approach | |
| Individual contact approach | |
| Mass media approach | |

9. For the different types of SFM practices, Score the level of effectiveness of the different methods used in training farmers
*Use the options 1= Not effective, 2=Least effective, 3=Moderately effective, 4= Effective.*

| **Extension method** | **Animal manure** | **Compost manure** | **Green Manure** | **Fertilizer** | **Combination of manure and fertilizer** | **Soil erosion control measures** |
|---|---|---|---|---|---|---|
| Field days | | | | | | |
| Workshops | | | | | | |
| Demonstration | | | | | | |
| Exchange visits | | | | | | |
| Farmer field school | | | | | | |
| Print media e.gBrochures/leaflets | | | | | | |
| Farmer to farmer extension | | | | | | |
| Mother–baby approach | | | | | | |
| Radio/TV | | | | | | |
| Video showing | | | | | | |
| Others (specify) | | | | | | |

10a. Have you involved other stakeholders in your activities? *1=Yes____ 2=No____*
10b. If yes, indicate for the last activity you held of its kind, who are the stakeholders involved? *Tick appropriately*

| **Activity** | **Field day** | **Demonstration** | **Workshops** | **FFS** | **Excursion** |
|---|---|---|---|---|---|
| Ministry of agriculture | | | | | |
| Other Researchers | | | | | |
| Farmers | | | | | |
| Provincial administration | | | | | |
| Agro input dealers | | | | | |
| NGOs | | | | | |

11.How would you rate communication level between extension personnel and farmers on SFM?*Tick the option*

| 1= poor | 2 = Fair | 3=Good | 4 = Excellent |
|---|---|---|---|
| | | | |

12. How would you rate communication level between extension personnel and researchers on SFM? *Tick the option,*

| 1 = poor | 3 = Fair | 3=Good | 4 = Excellent |
|---|---|---|---|
| | | | |

13. How easily do you access information related to soil fertility management technologies? *Rate the sources in terms of accessibility.1 =Not accessible, 2 =least Accessible, 3 = fairly accessible, 4 =Very Accessible,*

| **Source of information** | **Animal manure** | **Compost manure** | **Green Manure** | **Inorganic Fertilizer** | **Combination manure &fertilizer** | **Erosion control measures** |
|---|---|---|---|---|---|---|
| Research institutions | | | | | | |
| NGOs | | | | | | |
| Agro input dealers | | | | | | |
| Newsletter/Brochure | | | | | | |
| Books | | | | | | |
| Workshops/Seminars | | | | | | |
| TV& Radio | | | | | | |
| Scientific Conferences | | | | | | |
| Internet | | | | | | |
| Others(specify) | | | | | | |

14. From the below list of constraints which impede success of dissemination and knowledge sharing of SFM among agricultural stakeholders, *use the options given to score the severity of the problem 1=not critical, 2=Least critical 3=Moderately critical 4= Most critical*

| **Constraint** | **Score how critical the problem is** |
|---|---|
| Lack of basic infrastructures e.g. computer | |
| Limited time available | |
| Inadequate communication skills | |
| Ineffective policies | |
| Inadequate resource materials | |
| No opportunity to attend short term courses | |
| Little participation on research innovation | |
| Poor net working among stakeholders | |
| Low level of education of target groups | |
| Others (specify) | |

15. Give a suggestion(s) on how to overcome the barriers on dissemination of SFM research findings among agricultural stakeholders

1.
2.
3.
4.

**THANK YOU VERY MUCH.**