Assessing the Effectiveness of the Volunteer Farmer Trainer Approach in Dissemination of Livestock Feed Technologies in Kenya *vis-à-vis* Other Information Sources

Mercy Mwambi, Evelyn Kiptot and Steven Franzel

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United Nations Avenue
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Tel: +254(0)20 722 4000, via USA +1 650 833 6645
Fax: +254(0)20 722 4001, via USA +1 650 833 6646
Email: worldagroforestry@cgiar.org
Website: www.worldagroforestry.org

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THE AUTHORS

Mercy Mwambi works for the World Agroforestry Centre, Nairobi, Kenya.

Evelyn Kiptot works for the World Agroforestry Centre, Nairobi, Kenya.

Steven Franzel works for the World Agroforestry Centre, based in the USA.

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LIST OF ABBREVIATIONS & ACRONYMS

ABSTCM	African Breeding Services Total Cattle Management
AEZ	Agroecological Zone
AI	Artificial Insemination
ASK	Agricultural Society of Kenya
CESP	Community Extension Service Provider
CGIAR	Consultative Group for International Agricultural Research
DFBA	Dairy Farmers' Business Association
DMG	Dairy Management Group
EADD	East Africa Dairy Development
EV	Exchange Visit
FAO	Food and Agricultural Organization of the United Nations
FD	Field Day
FFE	Farmer-to-Farmer Extension
FO	Farmer Organization
ICRAF	World Agroforestry Centre
ICT	Information and Communication Technology
ID	Input Dealers
IFPRI	International Food Policy Research Institute
KARI	Kenya Agricultural Research Institute
LH	Lower Highland
LM	Lower Midland
MICCA	Mitigation of Climate Change in Agriculture
MoALFD	Ministry of Agriculture, Livestock and Fisheries Development
MP	Mobile Phone
NGO	Non-governmental Organization
PIM	Policies, Institutions and Markets

PSP	Private Service Provider
SF	Skilled Farmer
SRI	System of Rice Intensification
TV	Television
UH	Upper Highland
UM	Upper Midland
VFT	Volunteer Farmer Trainer

SUMMARY

Improvement in agricultural production, productivity and sustainability is dependent on farmers' access to up-to-date information on modern agricultural technologies. In the past, agricultural extension officers played an important role in disseminating knowledge from researchers to farmers. However, this linear model of extension was not effective. As a result, the extension system in developing countries has been changing to accommodate challenges presented by the linear model. Major modifications include the introduction of participatory approaches and the proliferation of many sources providing agricultural information. The sources could be interpersonal or impersonal. Farmers' choice of a particular source can be determined by various factors including socio-economic characteristics of the farmer, reliability, accessibility and affordability of the information source. Previous studies have been done to determine farmers' preferences for sources of information. However, little has been done to establish the type of information accessed from particular information sources. This study addresses the gap by assessing the effectiveness of the Volunteer Farmer Trainer (VFT) approach in disseminating information *vis-a-vis* other sources of knowledge. The VFT approach is a type of farmer-to-farmer extension model that is used by the East Africa Dairy Development (EADD) project in Kenya to disseminate information on livestock feed innovations. The objectives of the study were to identify farmers' sources of information, information source preference, access to and training on livestock feed technologies and technology sharing among farmers.

The findings indicate that radio was the most accessed source of information followed by Community Extension Service Providers (CESPs), neighbours, field days and the Ministry of Agriculture, Livestock and Fisheries Development (MoALFD); all accessed by more than 40% of the sampled farmers. With regard to gender, a significantly higher percentage of male farmers than female farmers had access to most of the information sources. Examples include radio, field days, agricultural shows, skilled farmers, written materials, demonstrations, newspapers, breeders' shows, mobile phones and posters. Clearly, male farmers have more access to both electronic and interpersonal sources of information than their female counterparts.

Results by household type show that a greater proportion of women-headed households had access to MoALFD and private service providers than women in male-headed households. Further, the findings reveal that VFTs were among the top five most accessed sources of information by women-headed households but was ranked 8th among women in male-headed households. The 5th rank obtained by the VFTs implies that farmer trainers were among the major accessed information sources by women-headed household perhaps because of their proximity, implying that less cost is needed to access them. The rank of VFTs varied across sites. Implications are that some farmers do not appreciate the VFTs which could be because they feel that fellow farmers might not have adequate skills and knowledge to educate them compared to other professional extension agents like the government extension staff. There

was no correlation between the ratio of farmers per VFT and percentage of farmers accessing information from VFTs per site.

In terms of the feed technologies accessed by farmers, findings indicate that Napier grass, mineral supplementation and concentrates formed the three most accessed feed technologies in that order. A significantly higher proportion of male farmers had access to information on modern feeds, such as Lucerne, desmodium, silage making and fodder shrubs than their female counterparts. Likewise, analysis by women household types shows that a higher percentage of women in male-headed households had access to information on Rhodes grass, conservation of crop residues and feed formulation than their counterparts in women-headed households.

With regard to the type of information accessed from particular sources, information on mineral supplementation, concentrates and Napier grass was mainly accessed from the radio. Other sources like CESP, field days and MoALFD offered information on Napier grass, Rhodes grass, silage making and conservation of crop residues. For VFTs, their main technologies were Napier grass, Rhodes grass, conservation of crop residues and mineral supplementation. Evidently, farmers access information on common feed technologies from impersonal sources while that on modern technology is accessed from interpersonal sources. Impersonal sources are important in passing general information while interpersonal sources are critical in providing specific information.

The most preferred sources of information of interviewed farmers were CESP followed by radio and MoALFD, in that order. This means that both interpersonal and impersonal sources are important in information dissemination. With regard to gender however, women had a higher preference for neighbours and thus made good use of their social networks than men who preferred field days. Compared to other information sources, VFTs fared relatively well ranking 7th overall with no major differences between the two genders.

Reliability, frequency of contact, accessibility and affordability of the three most preferred sources were analysed in this study. Further, similar aspects were used to rate how the VFTs fared compared to the three preferred sources. Despite the fact that VFTs were ranked 7th in preference, results show that the trainers were highly reliable, frequently contacted, highly accessible and affordable, thus making it an effective source of information. Their relatively low rank was in part because only one-fifth of farmer groups had VFTs and therefore few farmers had access to them. Overall, interpersonal sources were more reliable than impersonal sources because they could provide practical evidence.

Results on training depict that more than 50% of the farmers have been trained on Napier grass, silage making, Rhodes grass, mineral supplementation, conservation of crop residues and concentrates. Women receive training in similar technologies as men but with fewer percentages of farmers trained, except on mineral supplementation. Farmers reportedly received training from DFBAs, MoAFLD, Non-governmental Organizations (NGOs), Farmer Training Centres (FTC), input dealers, the Kenya Agricultural Research Institute (KARI), VFT, neighbours, Agricultural Shows of Kenya (ASK) and through self-experimentation.

With regard to information sharing, up to 72% of trained farmers shared information on technologies with other farmers, denoting the important role played by farmers in information dissemination. Majority of the trained farmers (>30%) have shared information on three technologies. In general, male farmers and women in male-headed households tend to share information more frequently than those in female-headed households. The top three technologies shared by farmers were Napier grass (75.4%), conservation of crop residues (46.9%) and mineral supplementation (39.3%).

After training, it is expected that farmers will adopt new technologies. This study examined the types of feed technologies practised by farmers. The three major technologies practised were mineral supplementation, Napier grass and concentrates, in that order. This was similar for both male and female farmers. However, there were significantly more men practising Rhodes grass, Lucerne and desmodium than women. Kikuyu grass appeared to be a prominent technology practised by more than 40% of the farmers. Evidently, traditional feeds are dominantly used. Comparing technologies trained with those shared/practised, results revealed a worrying trend on information diffusion among farmers. The percentages of farmers sharing and adopting Napier grass, conservation of crop residues and mineral supplementation technologies are similar. However, most farmers trained on Rhodes grass, Lucerne, silage making, hay baling and fodder shrubs did not adopt the technologies or share information with other farmers about them. This could be because of the cost involved in preparing the feed, lack of access to seeds, and the characteristics of the technology, for instance, the long wait before harvest.

Differentiating by sites, findings show that majority of the farmers (>85%) in the UM areas of Rift valley, mainly Tanykina and Kapcheno sites in Nandi county used kikuyu grass. Similar findings were reported in Olkalou and Metkei sites in UH areas of Rift Valley. Farmers in Cherang'ani region of Rift valley which is also an UM area and those from Kieni in central region, a LM area, used Napier grass more than kikuyu grass. In LH areas, particularly Sot and Taragoon sites, the commonly used livestock feed technologies were conservation of crop residues and Napier grass. Out of all feed technologies practised by farmers, Napier grass, kikuyu grass and conservation of crop residues were the three most preferred feed technologies in that order. Feed technology preference differed across sites with farmers in Cherang'ani, Kapcheno, Metkei, Olkalou and Kieni preferring Napier grass while those in Tanykina and Sot preferring kikuyu grass. Taragoon farmers preferred conservation of crop residues. It is evident that farmers prefer and practise feed technologies that are locally available.

In order to evaluate the level of understanding of feed technologies, farmers were asked questions on various livestock feeds including Napier grass, hay, silage, fodder shrubs and Rhodes grass. The average score of farmers understanding of livestock feed technologies shows that farmers have a good understanding of the tested knowledge. Farmers scored highly on questions regarding Napier grass while low scores were recorded on fodder shrubs. Thus these findings further point out the reason why few farmers adopted fodder shrub technology.

The findings confirm the importance and usefulness of the VFT approach. Although its preference ratings were not as high as those of CESP, VFTs were widely appreciated. In addition, the VFT approach is more affordable than the CESP, since VFTs receive no salaries. Nevertheless, the preference for CESP highlights the fact that VFTs are not substitutes for extension staff, but rather, complement their services. Increased training of VFTs and the fostering of close links with extension can help in developing effective and efficient extension systems.

1.0 INTRODUCTION

Improvement in agricultural production, productivity and sustainability is dependent on farmers' access and willingness to adopt improved technologies. Agricultural extension services support and facilitate farmers to solve problems and access information, skills and technologies to improve their wellbeing (Davis, 2008). Extension services also ensure that farmers' concerns are addressed by researchers, private institutions and other service providers. Agricultural extension has positive effects on technology adoption (Benin *et al.*, 2007) and promotes agricultural development and productivity (Anderson and Feder, 2007; Davis *et al.*, 2010; Benin *et al.*, 2011). Further, extension enhances human and capital formation and sustainable natural resource management (Leeuwis, 2003 and Swanson, 2008) as well as improving rural incomes (Egziabher *et al.*, 2013). It is evident that extension contributes directly to higher yields, innovations, poverty reduction, economic growth, environmental well-being and positive social returns.

Extension systems have been modified in recent years to meet the above mentioned roles. In the traditional approach to extension, knowledge is generated by researchers while the extension agents transfer the information to farmers. Farmers are in turn expected to adopt and improve their farming techniques. However, this extension system has been criticized as ineffective in meeting demands, especially of poor farmers (Rivera *et al.*, 2001; Birner *et al.*, 2006; Davis, 2008). Consequently, the extension systems were transformed from the earlier top-down models to more inclusive participatory extension approaches that are demand-driven and therefore focused on farmers' interests. These include farmer participatory research, farmer field schools, sustainable livelihood approach, innovation systems and farmer-to-farmer extension (FFE) approaches (Swanson and Rajalahti, 2010). Two other main modifications in extension systems were the inclusion of a broader range of topics in extension (e.g., marketing, promoting gender equality and organizing producers) and recognition that a broad range of actors, and not just government were involved in providing extension services (e.g., producer organizations, non-governmental organizations and agro-input suppliers). Improved extension systems have great potential for providing farmers with more and better information and strengthening their capacities to help them improve productivity and well-being (Sulaiman and Davis, 2012).

1.1 Farmer-to-farmer extension

The FFE approach involves training farmers who in turn train and share their knowledge and skills acquired with other farmers. The FFE approach is based on social and experiential learning theories (Bandura, 1993; Kolb, 1984) where ordinary farmers learn more from innovative neighbours, experiment and eventually adapt and use new technologies grounded in their socio-economic and biophysical circumstances. These farmer trainers are not usually paid for their services but receive free training and inputs from institutions implementing the projects (Lukuyu *et al.*, 2012). Farmer trainers have been reported in Matata *et al.* (2013), Shrestha (2013), Lukuyu *et al.* (2012), Kiptot and Franzel (2013) and Kiptot *et al.* (2011) to be those farmers who:

- Put into practice the farming practices being promoted

- Are able to experiment and implement new technologies
- Maintain a demonstration of good practices
- Train and coach other farmers and sometimes follow up on the progress of trained farmers.

Various studies (Wellard *et al.*, 2013 and Shrestha, 2013) discovered that FFE was cost effective, enhanced access to extension services by the poor and disadvantaged groups and increased participation by farmers in planning. In addition, FFE helps in budgeting and implementation of agricultural development programmes. Besides, the approach empowers the disadvantaged by providing them with opportunities to become extension agents and increases adoption of new technologies. For example, about 80% of farmers in selected sites of Ghana, Uganda and Malawi were found to participate in training on soil conservation, tree planting, composting, crop storage and livestock production technologies offered through the FFE approach (Wellard *et al.*, 2013). In another study, the number of farmers who adopted the System of Rice Intensification (SRI) in Ahero, Bunyala, West Kano and Mwea irrigation schemes in Kenya rose from 2 in 2009 to 2,000 farmers in 2010 as a result of learning from their trained counterparts (Mati, 2012).

FFE is highly favourably compared to other approaches because of advantages that farmer trainers have over other extension providers. Matata *et al.* (2013) note that farmers and trainers face similar constraints as they both have similar potential and aspirations. Thus, farmer trainers have the advantage of understanding the difficulties faced by fellow farmers because they have a more in-depth understanding of the local conditions and cultures compared to extension staff. Similarly, farmer trainers are readily available and accessible, hence can be approached by farmers whenever they are faced with any problem. The Volunteer Farmer Trainer (VFT) approach, a farmer-to-farmer extension approach, has been used by the East Africa Dairy Development (EADD) project to disseminate information on livestock feed technologies from farmer trainers to other farmers.

1.2 An overview of the East Africa Dairy Development Project

EADD is a regional development programme implemented in Kenya, Rwanda and Uganda by Heifer International, TechnoServe, International Livestock Research Institute (ILRI), the World Agroforestry Centre (ICRAF) and African Breeding Services Total Cattle Management (ABSTCM). The project was started in 2008 and aims at improving the lives of 179,000 families by doubling household dairy income by the 10th year through integrated intervention in dairy production, market access and knowledge application. To achieve this, EADD works in 21 sites in Kenya. The sites, commonly referred to as hubs, are managed by dairy farmers' business associations (DFBAs) located in several counties in Central and Rift Valley regions. Each DFBA has about 3000-10,000 members. DFBAs provide services such as bulking and selling milk, financial services, technical support, artificial insemination (AI) services, extension services and credit.

DFBAs recently employed extension officers, commonly referred to as community extension service providers (CESPs). Initially, the officers were paid by EADD, but this function has gradually been taken over by DFBAs. CESPs provide training to the DFBA members. The

training is organized at village level through groups commonly known as dairy management groups (DMGs). Training covers topics on feeds and feeding systems, breeding, animal health, milk quality, herd management, and group dynamics, among others. Apart from CESP, farmers also receive training through VFTs in the project. The VFT approach was started by the World Agroforestry Centre, a partner of the EADD project spearheading the livestock feed component. As of June 2012, EADD had 1443 VFTs who were operating in Kenya. The VFTs are selected through a participatory process involving their DMGs composed of about 20 farmers, project dissemination facilitators and the DFBAs.

The selection criteria as discussed by Kiptot and Franzel (2013) and Kirui *et al.* (2009) include:

- ✓ The ability to read and write
- ✓ The ability to interpret extension materials to farmers
- ✓ Membership of a farmer organization or cooperative society working with the EADD project
- ✓ Being a dairy farmer
- ✓ Having the willingness, interest and ability to disseminate new innovations and knowledge to others without pay
- ✓ Being a resident in the community
- ✓ Being willing to set aside land for setting up demonstrations.

After selection, VFTs are trained on feeds and feeding systems during an intensive, two-day course. They are supported to set up demonstration plots of various feed practices which include different grasses, fodder shrubs and herbaceous legumes. These demonstration plots are used as training grounds. VFTs are trained in feed conservation techniques which include silage making, hay baling, and management and utilization of crop residues. Project staff visit the VFTs from time to time and organize periodic training to improve their knowledge and skills. Some VFTs have the opportunity to participate in educational tours to innovative farms.

1.3 A review of farmers' sources of information

The demand for information has increased with increased complexities in agricultural production systems. Farmers need access to current information on modern agricultural technologies. There are various sources of information on agriculture. Farmers' choice of appropriate medium is crucial in information delivery (Cartmell *et al.*, 2004). The choice of information channel is dependent on the reliability, affordability, accessibility and type of information delivered through the source. Muhammad (2005) has classified sources of information into impersonal and interpersonal sources. Interpersonal sources mainly involve face-to-face exchange of information between individuals while impersonal sources are mass media type of information delivery where one or a few persons address many other people at a time. These sources can be further grouped into traditional (radio, extension agents, television, demonstrations, written materials, farmer trainers) and modern sources (internet, mobile phones).

Munyua (2000) notes that traditional media of agricultural information delivery have been used very successfully in developing countries. In particular, rural radio has played a major role in delivering agricultural messages. Similar studies have indicated that radio is a highly preferred source by farmers (Oriakhi and Okoedo-okojie, 2013; Oladeji *et al.*, 2011).

Djojmartono and Pertini (1998) elucidate that radio and television are more appropriate for one-way communication and reach a large number of people faster with fairly simple ideas. This however limits interaction between farmers and disseminators. Djojmartono and Pertini (1998) argue that interpersonal communication, including extension agents, group meetings, community organizations and demonstrations are the best ways to teach and develop credibility. This is not without limitations in that sometimes their effectiveness is hindered by time, space, human resources and budgetary constraints. Farmers therefore use a combination of these information sources to gain knowledge on agricultural technologies. In their study, Farooq *et al.* (2007) found that the common and highly used sources of information in Pakistan were fellow farmers, printed material, television and the private sector.

Many studies based on agricultural information have focused on farmers' sources of information (Rehman *et al.*, 2013; Farooq *et al.*, 2007), information needs and search behaviours (Babu *et al.*, 2012; Ali and Kumar, 2011; Metei and Devi, 2009), and socio-economic factors influencing access to information sources (Çukur and Saner, 2013). There is inadequate information on the effectiveness of these information sources in dissemination of technologies. This study was intended to fill this knowledge gap by examining the effectiveness of the VFT approach as compared to other sources of information in dissemination of livestock feed technologies among dairy farmers in the EADD project sites in Kenya. Further analysis on information preferences, reliability, frequency, accessibility and affordability of the sources, training and technologies received and disseminated by farmers was carried out.

1.4 Justification for the study

Farmers obtain information on new agricultural technologies through different avenues. In this modern era, farmers need to use media that deliver timely and relevant information to improve their farming practices. Following the importance of VFTs and other information sources in extension delivery, assessing their effectiveness is worthwhile. The findings of this study provide insights to farmers, extension service providers, researchers and policy makers on the use of different sources of information for agricultural development. The results provide information on the training received by men and women farmers, adoption of technologies and sharing of information received between men and women farmers.

1.5 Objectives of the study

The objectives of the study include to:

1. Identify farmers' sources of information on livestock feed technologies and determine farmers' preferences.

2. Identify the number and type of livestock feed technologies accessed by farmers through the VFTs and other sources of information.
3. Determine the number of farmers trained; the type of feed technologies that farmers have received training on and technologies practised.
4. Examine farmers' level of understanding of livestock feed technologies on which they had received training.
5. Determine the number of farmers sharing information with other farmers.
6. Assess the association between different sources of information and training, uptake and sharing of livestock feed technologies.

Data has been broken down by gender in order to assess the differences between men and women.

2.0 METHODOLOGY

2.1 Evaluation framework

Studies have used different approaches to assess the effectiveness of information sources in extension delivery. Wellard *et al.* (2013) measured the effectiveness of the farmer trainer approach by assessing how community-based extension approaches have contributed to improved food security and livelihoods of smallholders. The study considered factors such as training, number of farmers using soil conservation, tree planting, composting, crop storage, livestock production technologies, the state of household productivity and changes in their livelihood and assets. Ssemankula and Mutimba (2011) assessed effectiveness of the FFE model using increased technology uptake, increased production, increased food availability, multiplier effect in information sharing and increased sales of commodities.

In their study on assessing the effectiveness of mass media in disseminating agricultural technologies in Nigeria, Ariyo *et al.* (2013) looked at the extent to which the respondents had benefited from mass media in terms of adoption of agricultural technology. The study reported that 90% of farmers found mass media effective. In this study, effectiveness of VFT approach *vis-a-vis* other sources of information was assessed based on the following four aspects:

1. The proportion of farmers accessing information from the VFTs as well as other information sources.
2. The proportion of farmers trained by VFTs and other training institutions.
3. The number of women trained and the number of technologies implemented by women.
4. Farmers' level of understanding of livestock feed technologies.
5. The number of farmers sharing technologies with other farmers.

2.2 Synopsis of EADD sites

The EADD Kenya project is implemented in nine districts in Rift Valley region including: Bomet, Buret, Keiyo, Kipkelion, Marakwet, Molo, Nandi North, Uasin Gishu and West

Pokot and two districts in Central region: Nyandarua and Nyeri districts. Currently, EADD has 21 sites in the two regions (EADD-MICCA Project Final Report, 2012). A site is defined in relation to dairy farmers limited company referred to as dairy farmer business associations (DFBAs) in the project. EADD sites include Tinderet, Olchobosen, Sirikwa, Cherang'ani, Lelan, Leichago, Taragoon, Kepkelion, Cherobu, Kokiche, Metkei, Kapcherio, Olkalou, Siongoroi, Olenguruone, Sot, Chepkorio, Kabiyet, Kaptuma, Mweiga and Tanyikina. These sites, commonly known as hubs, have chilling plants that store and sell milk and provide other services on agro-veterinary supplies and improved fodder. The hubs are managed by DFBAs which are shareholders in the plants and are located within the community. The total number of registered farmers under EADD project in Kenya was 107,566 as at 2012.

2.3 Study area

The study sites are located in North Rift, South Rift, Central Rift and Central regions of Kenya. Central region and South Rift Valley are characterized by bimodal type of rainfall with the short rains falling in October to December and the long rains in March to May. North Rift receives a unimodal type of rainfall with a long rainy season and a short dry season between November and February. Dairy farming is prevalent in all the study sites. The cattle feeding systems practised range from intensive to extensive systems where cattle graze freely on private/public land, in paddocks or are tethered. The intensive feeding system is prevalent in Central Rift and Central region of Kenya while pure grazing is common in the North and South Rift (Kiptot and Franzel, 2012). Nearly all dairy farmers also cultivate several crops for both subsistence and to earn cash. The major crops grown in Central Kenya and Central Rift are maize, beans and Irish potatoes with flowers dominating in the cash crop sector. In the North Rift regions, beans, maize, wheat, sweet potatoes, sorghum, vegetables and fruits such as passion can be found in most farming households. The South Rift region supports the growing of maize, beans, sweet potatoes, bananas, sorghum and finger millet. The main cash crops are tea and pyrethrum (Lukuyu *et al.*, 2011).

2.4 Sampling procedure

2.4.1 Sampling technique

Selection of study DFBAs was based on their year of formation and agro-ecological zones (AEZ). The oldest DFBA was formed in 2008 while the most recent was formed in 2012. To avoid bias due to the period of implementation of the program, two DFBAs that were formed after 2010 were dropped, leaving a total of 19 DFBAs. Afterwards, the location of the DFBAs was established. The DFBAs were located in four AEZs classified as Upper Midland (UM), Upper Highland (UH), Lower Highland (LH) and Lower Midland (LM) in South Rift, North Rift and Central regions of Kenya. A number of DFBAs were randomly selected proportionate to the number of DFBAs per AEZ. Consequently, two DFBAs were selected from UH, two from LH, three from UM and one DFBA from LM. This gave a total of eight DFBAs for the study. Finally, dairy productivity was measured using scores defined by EADD and applied at the DFBA level. Sample sites were also checked for their production stage scores, that is, their assessed productivity levels. The lowest score is 1 whereas the highest is 5. The selected DFBAs showed varied production scores ranging from 2-4 and

representative of the 21 sites. Therefore, no changes were made in the sampling. The DFBA's included Cherang'ani, Tanykina, Kapcheno, Metkei, Olkalou, Taragoon, Sot and Kieni.

The lists of farmers who are members of the DFBA's were obtained from EADD and systematic sampling design was carried out to sample households for the study. The farmers were sampled proportionate to the population size of the DFBA. The farmers selected for the interviews consisted of both men and women. A replacement list was obtained using the above procedure to replace farmers who were not available during the interview. The location of farmers interviewed is shown in Figure 1 and the distribution of farmers across DFBA's and counties are as presented in Table 2.

2.4.2 Sample size

The selected sites had a total of 41,889 farmers. A sample size of 384 households was obtained using Cochran's (1977) formula given as:

$$n = \frac{z^2 * pq}{E^2}$$

Hence

$$n = \frac{1.96^2 * 0.5 * 0.5}{0.05^2} = 384$$

Where;

Z is the Z value at 95% confidence level given as 1.96, p=proportion of the population containing the major interest given as 0.5, q=1-p=0.5 and E=acceptable/allowable error of 0.05. A summary of the selected study sites and the sample size is as provided in Table 1 below.

The 41,889 farmers were organized into about 2,094 DMGs, assuming 20 farmers per group. Comparing the sample size obtained per site with the number of VFTs available per site (Table 1), it is estimated that only 19.7% of the groups, or about 1 in 5 had a VFT.

Figure 1: Interview locations

Table 1: Summary of sampled sites

AEZ	No. sites	Study sites selected	County	Region	Year of formation	Total population	Production stage score	Sample size	No. of VFTs	
UM	12	3	Cherang’ani	Trans Nzoia	North Rift Valley	2010	5905	2	59	143
			Tanykina	Nandi	North Rift Valley	2008	13,004	4	131	72
			Kapcheno	Nandi	South Rift Valley	2010	3352	3	34	58
UH	4	2	Metkei	E.Marakwet	North Rift Valley	2009	1866	4	19	25
			Olkalou	Nyandarua	Central	2008	6633	3	67	38
LH	3	2	Taragoon	Uasin Gishu	North Rift Valley	2010	1972	2	20	10
			Sot	Bomet	South Rift Valley	2008	5981	3	60	20
LM	2	1	Kieni	Nyeri	Central	2008	3176	3	32	76
Total	21	8				41,889		422	412	

*Highest production stage score is 5, lowest score is 1

2.5 Data collection and analysis

A structured questionnaire was used to obtain data from sampled farmers. The questionnaire captured information in line with the specified objectives as mentioned in section 1.5.

Questions covered the household socio-economic characteristics, livestock production, gender involvement and information sources for livestock feed technologies. Data entry and analysis was carried out using SPSS software. Descriptive statistics such as frequency counts, percentages, mean and standard deviations were used to address the four objectives. Farmers' preferences of sources of information were also established. This was done by rating the sources as high, medium and low in preference. Scores of 3, 2 and 1 were then assigned to high, medium and low preferred sources, respectively. The scores were multiplied by the frequencies and the row sum calculated to obtain total score. The total score gave the ranks which indicated farmers' preference in terms of extent of use and quality of a particular source. Farmers who did not score were assigned a 0 score.

3.0 RESULTS

3.1 Demographic and socio-economic characteristics of farmers

A total of 233 (55%) male and 190 (45%) female farmers were interviewed. Farmers' main demographic and socio-economic characteristics are shown in Table 2. All farmers had an average age of 46.3 years but female farmers were slightly younger (45.6 years) than their male counterparts (46.8 years). About 18.7% of the farmers were in the youth category (18-34 years), 61.7% were of middle age (35-59 years) while 19.6% were elderly (>59 years). Dairy farming in the sampled sites is mainly practised by middle-aged people. Youth are less involved perhaps because they lack the needed capital or because they do not find dairy farming enticing.

Most of the farmers were married (83.2%). Disaggregating by gender, it can be seen that there were more married men than women. The difference was highly significant. Farmers had an average of 9.5 years of schooling, which indicates that they had attained a minimum of primary school education and some years of post-primary education. Compared to their female counterparts, male farmers had significantly more years of education. Education positively influences decision-making on agricultural production and therefore male farmers are expected to be better decision makers than their female counterparts. The results on age correspond to the number of years of farming experience where all farmers had fairly long experience in dairy farming (14 years). However, female farmers reportedly had a year less of experience compared to their male counterparts. Most of the farmers were trained on improved livestock feed technologies (90%) and were therefore aware of these technologies. In terms of group membership, there were more female farmers participating in groups (67.4%) than male farmers (57.1%). Groups create a forum for exchange of information among farmers and are therefore critical in facilitating agricultural development.

Table 2: Socio-economic characteristics of individual farmers interviewed

Variable	Male (n=233)	Female (n=190)	All (n=423)	t/ test	chi square
Farmer characteristics					
Age	46.8 (13.6)	45.6 (13.37)	46.3 (13.49)	0.928	0.928
<i>% age groups</i>					
15-34 years	19.3 (0.03)	17.9 (0.03)	18.7 (0.02)		12.89
35-59 years	59.7 (0.03)	64.2 (0.03)	61.7 (0.02)		22.31
>59 years	21.0 (0.03)	17.9 (0.03)	19.6 (0.02)		24.48
					11.732**
<i>Marital Status</i>					
Never married (%)	11.2	11.1	11.1		*
Married (%)	86.3	79.5	83.2		
Widowed (%)	2.2	9.7	5.4		
Divorced/separated (%)	0.4	0	0.2		
Education	10.1 (3.55)	8.7 (3.97)	9.5 (3.81)	3.940***	
Experience in dairy (years)	14.7(11.32)	14.3 (10.89)	14.5 (11.08)	0.358	
Group membership (%)	57.1	67.4	61.7		4.687**

***p<0.01, **p<0.05,*p<0.1; figures in parenthesis present the standard deviations

About 9% of the households were female-headed. Women in female-headed households were 7 years older than women in male-headed households thus explaining why women in female-headed households had more years of experience in dairy farming (Table 3). Old age is linked to reluctance to adopt new technologies and thus female-headed households may be less willing to try modern livestock feed technologies.

Women in female-headed households were less educated than women in male-headed households and the difference was significant. The low levels of education could have limited the participation of female heads in training as indicated by the low percentage of trained farmers in this category. The difference in training between the two categories was highly significant. Lack of training could have a negative impact on farmers' level of understanding of livestock feed technologies and farmers' access to information on livestock feeds. There were no significant differences in group membership between female heads and women in male-headed households. Overall, women in female-headed households were older, more experienced in dairy, less trained and less educated compared to females in male-headed households.

Table 3: Socio-economic characteristics of women farmers interviewed

Variable	Women in female-headed households (N=39)	Women in male-headed households (N=151)	t/test	Chi square
Age	50.8 (15.2)	44.2 (12.5)	-2.778**	0.437
Education	7.5 (4.8)	9 (3.6)	2.119**	
Experience in dairy	17 (13.4)	13.6 (10)	-1.78*	
Group membership (%)	71.8 (0.07)	66.2 (0.03)		

***p<0.01, **p<0.05, *p<0.1; figures in parenthesis present the standard deviations

3.1.1 Participation in groups

As indicated in Table 2 above, 61.7% of the farmers were in groups. The groups were either agricultural (livestock, horticulture) or non-agricultural (e.g. savings and credit, welfare, religious) (Table 4). Majority of the farmers (55.3%) participated in savings and credit groups. Participation in such groups enhances farmers' ability to access credit from microfinance organizations, marketing agents or input suppliers, which in turn boosts investment in agriculture. Other important groups were agricultural (44.7% of farmers) and welfare groups (38.5% of farmers). Agricultural groups are considered vital sources of information mostly through trainers or other farmers. With regard to gender, more female farmers participated in savings and credit groups than male farmers who were inclined to agricultural, welfare and community groups. Unlike men, women farmers often lack physical collateral which limits their access to credit facilities from formal institutions. Thus, most of them opt for informal savings and credit schemes such as group lending.

Table 4: Farmers' membership in groups

Type of group	% male (N=135)	% female (N=127)	Total (N=262)
Savings and credit	43.0	68.5***	55.3
Agricultural	54.1	34.6***	44.7
Welfare	44.4	32.3*	38.5
Religious	14.8	11.0	13.0
Education	11.1	7.9	9.5
Community	13.3	4.7**	9.2
Clan	5.9	2.4	4.2

***p<0.01, **p<0.05, *p<0.1; NB: N refers to number of farmers in groups, 161 farmers did not participate in any group

Generally, women in male-headed households did not differ significantly from those in female-headed households in terms of participation in various groups, except that the former were less active in educational groups (Table 5).

Table 5: Percentage of female farmers participating in groups

Group type	% of women farmers in female-headed households (N=28)	% women farmers in male headed households (99)
Savings and credit	67.8	68.7
Agricultural	32	35.4
Welfare	35.7	31.3
Religious	7.1	12.1
Education	10.7	0.07
Community	0	0.06
Clan	3.6	0.02

N represents farmers in groups; 63 female farmers were not in groups

Farmers were engaged in diverse enterprises and many of these are accounted for in the groups to which they belonged. A large proportion of the farmers were involved in dairy production groups (55%) which indicates that the sample was drawn from members of a dairy cooperative (Table 6). Membership in other enterprise-related groups included livestock feed production (23.9%), horticulture (18.8%), dairy goat (17.1) savings and credit (16.2%), subsistence farming (13.7%) and poultry (12%). The enterprises practised in agricultural groups did not differ between male and female farmers. Participation in various agricultural group enterprises was similar between male and female farmers. However, a significantly higher percentage of male farmers engaged in welfare support activities.

Table 6: Percentage of farmers belonging to groups concerned with specific agricultural enterprises

Enterprise	Male (N=73)	Female (N=44)	Total (N=117)
Dairy cattle	53.4	59.1	55.6
Livestock feed production	21.9	27.3	23.9
Horticulture	20.5	15.9	18.8
Dairy goat	15.1	20.5	17.1
Savings and credit	12.3	22.7	16.2
Subsistence farming	15.1	11.4	13.7
Poultry	8.2	18.2	12.0
Welfare support	13.7	0.0**	8.5
Cash crop	8.2	6.8	7.7
Agroforestry	4.1	6.8	5.1
Sheep	1.4	2.3	1.7
Bee keeping	2.7	0.0	1.7

***p<0.01, **p<0.05,*p<0.1; N refers to number of farmers in agricultural groups, 306 farmers were not in agricultural groups

Farmers participate in agricultural groups for different reasons. The data in Table 7 shows that the major benefits derived from participating in agricultural groups include access to information (90.6%) and collective marketing (80.3%). Access to ready market was of greater importance to male farmers than female farmers. Female farmers on the other hand,

mentioned welfare support as a major benefit. Evidently, male farmers participated in groups to access markets while women farmers participated in groups for social gains.

Table 7: Benefits derived by farmers from participating in agricultural groups

Benefit	Male (N=73)	Female (N=44)	Total (N=117)
Information	91.8	88.6	90.6
Collective marketing	80.8	79.5	80.3
Credit/loan	56.2	59.1	57.3
Ready market	60.3	38.6**	52.1
Input	45.2	52.3	47.9
Welfare	41.1	56.8*	47.0

N refers to number of farmers in agricultural groups, 306 farmers were not in agricultural groups

3.1.2 Household wealth characteristics

The housing material was used as a proxy for wealth. About 92.6% of the farmers used iron sheets for roofing and thus were considered middle-income. Obviously, the middle class was overrepresented in the sample. Dairy farmers are thought to be of medium wealth given that they could afford to own a cow. Only 6.9% of the farmers used thatch for roofing, thus representing poor farmers in the study sites. About 0.5% of the farmers had tiled roofs. These formed the wealthy category.

With regard to land ownership, Table 8 indicates that both male- and female-headed households had an average land size of 2.6ha. Male-headed households had a mean of 3.7 cows with the female-headed households owning 3.3 cows. There were no significant differences in land and cow ownership between male- and female-headed households. Likewise, the proportion of households with cross-bred (87.5%), pure-bred (12.3%) and local-bred (4.5%) cattle was similar among male- and female-headed households. The high percentage of households owning cross-breed cows in the project sites could be linked to increased awareness of the use of artificial insemination (AI) promoted by the EADD project. Farmers receive AI services from trained extension staff in the DFBAs.

Table 8: Farm characteristics of household heads

Variable	Male-headed households (N=384)	Female-headed households (N=39)	Total (N=423)
Land size (ha)	2.6 (1.8)	2.6 (1.8)	2.6 (1.8)
Number of cows	3.7 (2.98)	3.3 (2.0)	3.65 (2.9)
<i>Cow breed owned (%)</i>			
Local	4.4 (0.01)	5.1 (0.03)	4.5 (0.02)
Cross	87.8 (0.01)	84.6 (0.06)	87.5 (0.02)
Pure	12.2 (0.02)	12.8 (0.05)	12.3 (0.03)

Given the diversity of study sites in terms of population size and density, agro-ecological conditions and culture, the study analysed land size and number of cows owned by site.

Figure 2 shows that land and cow ownership varied across sites. Households in Taragoon, Metkei, Tanykina and Cherang'ani had relatively larger land sizes than other sites, with households in Kapcheno and Kieni sites owning the smallest land sizes. The number of cows owned by households was high in Taragoon and Olkalou. Households in Sot and Kapcheno sites had the least number of cows.

Figure 2: Land size (ha) and cow ownership by site

3.1.3 Livestock type owned and livelihood sources of households

Dairy cattle, poultry and sheep comprised the three major livestock kept by 100%, 83.9% and 50.1% of households respectively (Table 9). Specifically, farmers owned an average of 3.6 cows, 12.8 poultry birds and 5.8 sheep. Households owned more poultry and sheep compared to cattle because they require smaller spaces and are easy to manage. Poultry and sheep are a good alternative source of income for farmers during low milk production seasons, and thus are mainly kept to diversify income sources.

Table 9: Number and type of livestock owned by farmers

Type of livestock	% of all households(N=423)	Mean (standard deviation)
Dairy	100	3.6 (2.91)
Poultry	83.9	12.8 (8.59)
Sheep	50.1	5.8 (4.21)
Beef	28.4	1.9 (1.44)
Goats	15.8	4.6 (3.5)
Donkeys	14.7	1.2 (0.59)
Bees	8.0	4.8 (3.99)
Rabbit	5.2	7.5 (5.18)
Pigs	0	0

The livelihood sources of interviewed households are presented in Figure 3. All farmers (100%) practised dairy and subsistence farming and hence the two are the most important sources of livelihood. Other main livelihood sources identified by farming households

included poultry farming (77.3%) sheep rearing (44.2%) and cash crop farming (33.3%) (i.e., tea in Kapcheno and sugarcane in Tanykina).

Figure 3: Livelihood sources

3.2 Sources of information on livestock feed technologies

In response to the question on the sources of information accessed, farmers identified 24 different sources that they used (Table 10). Almost two-thirds of those interviewed had access to information from radio which formed the most accessed source of information. This was followed by CESP, neighbours, field days and MoALFD, each used by about 44% to 50% of the farmers. With regard to gender, both male and female farmers accessed information from similar sources. However, male farmers reported field days and CESP as their second and third most accessed sources respectively, while female farmers reported CESP and neighbours. Additionally, a comparatively higher percentage of male farmers had access to a number of information sources. Examples include radio, field days, agricultural shows, skilled farmers, written materials, demonstrations, newspapers, breeders' shows, mobile phones and posters.

Table 10: Percentage of farmers accessing information from different sources by gender

Source of Information	%Male (N=233)	%Female (N=190)	%Total (N=423)
Radio	69.5	55.8	63.4**
CESPs	46.4	52.6	49.2
Neighbours ¹	45.9	46.8	46.3
Field days	53.6	35.3	45.4***
MoALFD	45.1	42.6	44.2
VFTs	29.6	23.2	26.7
Agricultural shows (ASK)	32.2	16.3	25.1***
Input dealers	20.6	24.2	22.2
Exchange visits	23.6	20.5	22.2
Farmer Cooperatives	19.7	24.2	21.7
Skilled farmers ²	21.9	15.3	18.9*
TV	15.9	10.5	13.5
Written materials	15.5	8.9	12.5**
Demonstrations	15.0	7.9	11.8**
NGO	11.2	8.9	10.2
Farmers organizations/groups other than DMGs	12.0	7.9	10.2
Newspapers	11.2	5.3	8.5**
Private service providers	9.4	6.3	8.0
Breeders show	9.9	3.2	6.9**
KARI	3.9	5.3	4.5
Mobile phone	6.9	1.6	4.5**
Posters	6.4	2.1	4.5**
Internet	3.0	1.6	2.4
Commodity traders	1.3	0.0	0.7

***p<0.01, **p<0.05, *p<0.1

Compared to other sources, the VFTs were ranked 6th overall and were accessed by 26.7% of farmers. Given that only 19.7% of DMGs had volunteer farmer trainers, the data shows that VFTs were an important source of information in DMGs where they were available, and in a limited number of other DMGs as well. Male farmers ranked VFTs 7th while female farmers ranked it 8th.

Disaggregating by household type, results in Table 11 show that a higher proportion of women in male-headed households had access to the MoALFD and private service providers. The VFTs were ranked 5th by women in female-headed households and 8th by women in male-headed households.

¹ Neighbours include those who reside near the respondent, normally in the next farm or house.

² Skilled farmers are farmers who have expertise in agricultural technologies and are located either within or outside the local community

Table 11: Women's access to sources of information

Source of information	% women in female-headed households (N=39)	% female in male-headed households (151)
Radio	56.4	55.6
CESPs	51.3	53
Neighbours	48.7	46.4
Field days	28.2	37.1
MoALFD	25.6	47**
VFTs	25.6	22.5
Agricultural shows (ASK)	12.8	17.2
Input dealers	25.6	23.8
Exchange visits	17.9	21.2
Farmer Cooperatives	25.6	23.8
Skilled farmers	17.9	14.6
TV	7.8	11.3
Written materials	7.8	9.2
Demonstrations	7.8	7.9
NGO	7.8	9.3
Farmers organizations/groups	7.8	7.9
Newspapers	2.6	5.9
Private service providers	12.8	4.6*
Breeders show	5.1	2.6
KARI	2.5	6
Mobile phone	0	2
Posters	2.5	1.9
Internet	2.5	1.3
Commodity traders	0	0

***p<0.01, **p<0.05,*p<0.1

Table 12 below illustrates the considerable differences in access to sources of information across farmers in different DFBA's. It is apparent that CESPs were the most accessed source of information in Cherang'ani (80.3%), Metkei (47.4%) and Sot (68.3%). Radio was accessed by more than 45% of the farmers in Tanykina, Kapcheno, Metkei, Olkalou and Taragoon, while the MoALFD was predominant in Kieni. Relative to other sources, VFTs featured 2nd in Kieni and Sot, 3rd in Kapcheno, and were also accessed in other sites.

Table 12: Farmers access to sources of information by DFBA

Source	Cherang'ani (N=61)	Tanykina (N=131)	Kapcheno (N=34)	Metkei (N=19)	Olkalou (N=67)	Taragoon (N=19)	Sot (N=60)	Kieni (N=32)
MOALFD	73.8	8.4	35.3	31.6	29.9	36.8	58.3	81.3
NGO	11.5	0.8	44.1	5.3	9	5.3	8.3	12.5
Farmer organizations	11.5	6.9	5.9	0	6	26.3	15	15.6
KARI	18.0	0	0	5.3	3	15.8	0	6.3
Farmer cooperatives	4.9	32.8	5.9	10.5	21	21.1	20	28.1
VFTs	27.9	6.9	44.2	10.5	14.9	15.8	46.7	62.5
CESPs	80.3	22.1	35.3	47.4	35.8	31.6	68.3	43.8
Skilled farmers	29.5	17.6	11.8	10.5	22.4	26.3	11.7	6.3
Neighbours	49.2	65.7	52.9	26.3	28.4	26.3	13.3	50
Input dealers	3.8	16.8	0	0	37.3	31.6	33.3	28.1
Commodity traders	0	0.8	0	0	0	0	0	3.1
Private service providers	9.8	0.8	0	5.3	4.5	21.1	18.3	21.9
Mobile phone	1.6	9.9	2.9	5.3	0	0	0	0
Radio	34.4	69.5	79.4	47.4	49.3	47.4	60	56.3
Television	8.2	20.6	23.5	15.8	3	10.5	5	6.3
Newspaper	8.2	10.7	2	5.3	1.5	10.5	8.3	3.1
Posters	0	6.1	2.9	5.3	0	5.3	3.3	9.4
Writing materials	11.5	7.6	2.9	0	13.4	0	23.3	21.9
Internet	4.9	1.5	0	0	0	0	3.3	6.3
Exchange visits	34.4	9.2	11.8	21.1	9	15.8	35	21.9
Demonstrations	6.6	6.9	5.9	10.5	3	10.5	25	18.8
Field days	59.0	42.8	35.3	42.1	29.9	42.	40	37.5
Agricultural shows	34.4	33.6	11.8	15.8	9	21.1	8.4	40.6
Breeders' show	13.1	4.6	0	15.8	4.5	0	3.3	12.5

Next, the association between the percentage of farmers accessing information from VFTs with the proportion of VFTs in the site was established. The ratio of VFT to farmer per site was also calculated to give the number of farmers being attended to by one VFT. The highest percentage of farmers accessing information from VFTs was recorded in Kieni DFBA (62.5%) (Table 13). The site had the highest proportion of VFTs (1/42). This signifies the importance of VFT numbers in enhancing access to information from trained farmers. An increase in the number of VFTs is likely to lead to an increase in contact between farmers and VFTs.

However, this is not always the case. For instance, the results show that Sot had the second highest percentage of farmers (46.7%) accessing information from the VFTs. This is despite the site having the lowest proportion of VFTs (1/299). The correlation test revealed no association between the ratio of farmers per VFT and the percentage of farmers accessing information from VFTs per site. The study suggests that there are other factors such as activeness of the trainers or availability of other sources of information that could determine farmers' access to information from them. The relatively small sample size per site (Table 1) may also be responsible for these results. Sites with a low percentage of farmers accessing information from VFTs and low percentage of VFTs included Taragoon, Olkalou and Tanykina. Kieni site had the lowest ratio of VFT to farmer while Sot had the highest.

Table 13: Percentage of farmers accessing information from VFTs and percentage of VFTs per site

Site	Number of farmers accessing information from VFTs	% of farmers accessing information from VFTs	Number of VFTs per site	% of VFTs per site	Ratio of farmers to VFTs
Kieni	20	62.5	76	2.4	41.8
Sot	28	46.7	20	0.3	299
Kapcheno	15	44.2	58	1.7	57.8
Cherang'ani	17	27.9	143	2.4	41.3
Taragoon	3	15.8	10	0.5	197.2
Olkalou	10	14.9	38	0.6	174.6
Metkei	2	10.5	25	1.3	74.6
Tanykina	9	6.9	72	0.5	180.6

3.3 Types of livestock feed technologies accessed from various information sources

Irrespective of the source, more than 50% of the farmers accessed information on nine different livestock feed technologies namely Napier grass, mineral supplementation, concentrates, silage making, Rhodes grass, conservation of crop residues, hay baling, feed formulation and fodder shrubs (tree lucerne (*Chamaecytisus palmensis*), calliandra (*Calliandra calothyrsus*) and trichandra (*Leucaena trichandra*) (Table 14). Overall, less than 10% of the farmers had access to information on Columbus grass, Giant setaria, purple vetch, lablab and lupine. This could be partly because of lack of awareness. Male farmers differed from women in a number of respects. A greater proportion of male farmers had access to information on lucerne, desmodium, silage making and fodder shrubs than female farmers. It could be male farmers had more time than their female counterparts to visit farmers/ demonstrations on these modern feed technologies. For other species and feeds, roughly the same percentage of women and men had accessed information.

Table 14: Types of livestock feed technologies accessed from all sources by gender

Type of livestock feed technology	% male (n=233)	% female (n=190)	% total (n=423)
Grasses			
Napier grass	89.7	86.8	88.4
Rhodes grass	71.7	70.0	70.9
Columbus grass	10.7	6.8	9.0
Giant setaria	7.3	5.3	6.4
Herbaceous legumes			
Lucerne	52.4	35.3***	44.7
Desmodium	37.3	29.5*	33.8
Lupine	7.7	4.7	6.4
Purple vetch	3.4	3.7	3.5
Lablab	3.9	2.1	3.1
Conserved feeds			
Silage making	81.5	70.5***	76.6
Conservation of crop residues	71.2	68.9	70.2
Hay baling	60.1	52.6	56.7
Fodder trees and shrubs			
Fodder shrubs	56.7	47.9*	52.7
Tree Lucerne	15.9	16.8	16.3
Fodder grain crops			
Sorghum	34.3	35.8	35.0
Oats	27.5	22.1	25.1
Root crops			
Sweet potato vines	45.5	41.1	43.5
Edible cana	1.7	1.1	1.4
Other feeds			
Mineral supplementation	86.3	88.4	87.2
Concentrates	79.4	80.5	79.9
Feed formulation	55.4	55.8	55.6

***p<0.01, **p<0.05,*p<0.1

Women in male-headed households and female-headed households had similar access to livestock feed information except on a few practices. For instance, as seen in Table 15, women in male-headed households had significantly more access to information on Rhodes grass, conservation of crop residues and feed formulation compared to those in female-headed households.

Table 15: Types of livestock feed technologies accessed from all sources by women

Type of livestock feed technology	% female-headed households (n=39)	% female in male-headed households (n=151)
Grasses		
Napier grass	79.5	88.7
Rhodes grass	56.4	73.5**
Columbus grass	2.6	7.9
Giant setaria	7.7	4.6
Herbaceous legumes		
Lucerne	33.3	35.8
Desmodium	35.9	27.8
Lupine	7.7	4.0
Purple vetch	5.1	3.3
Lablab	5.1	1.3
Conserved feeds		
Silage making	64.1	72.2
Conservation of crop residues	56.4	72.2*
Hay baling	46.2	54.3
Fodder trees and shrubs		
Fodder shrubs	41.0	49.7
Tree Lucerne	20.5	15.9
Fodder grain crops		
Sorghum	43.6	33.8
Oats	20.5	22.5
Root crops		
Sweet potato vines	35.9	42.4
Edible cana	2.6	0.7
Other feeds		
Mineral supplementation	84.6	89.4
Concentrates	66.7	84.1
Feed formulation	41.0	59.6**

***p<0.01, **p<0.05,*p<0.1

The percentages of farmers who accessed information on various livestock feed technologies from different sources are illustrated in Table 16 below. Information on mineral supplementation and concentrates was mainly accessed through radio. Other sources such as CESP, field days and MoALFD were helpful to farmers accessing information on Napier grass, Rhodes grass, silage making, conservation of crop residues and fodder shrubs. From this it's deduced that farmers prefer accessing information on familiar practices from radio while information on new practices is accessed largely from interpersonal sources. Trainings offered through CESP, field days and MoALFD are in most instances accompanied with practical sessions which probably support farmers learning on modern technologies.

In addition, the table shows important technologies for each source. For instance, Napier grass, Rhodes grass and silage were the most important technologies for MoALFD, CESP and field days. For VFTs, their main technologies were Napier grass, Rhodes grass, conservation of crop residues and mineral supplementation. Radios had concentrates, mineral supplementation and Napier as their three key technologies.

Table 16: Farmers' access to livestock feed technologies from different sources

Feed technology	MoA	NGO	FO	KARI	VFTs	CESPs	SF	Neighb	ID	PSP	MP	Radio	TV	NP	WM	Int	EX	Demo	FD	ASK
Grasses																				
Napier grass	26.0	2.8	7.8	3.5	16.3	28.1	7.3	15.4	0.9	3.8	1.4	17.3	4.7	2.1	6.1	0	9.7	3.8	22.7	9.5
Rhodes grass	18.2	1.7	4.7	2.4	10.9	21.7	4.5	11.8	2.1	3.1	0.9	10.9	1.4	1.4	5.2	0	8.0	3.1	20.1	10.4
Columbus	0.9	0	0.7	0.5	0.9	2.4	0.7	0.7	0.7	0	0	0.7	0.2	0	0	0	0.5	0.2	1.7	0.5
Giant setaria	0.7	0.5	0	0.5	0.9	0.5	0.5	0	0	0.5	0	0.5	0.5	0.2	0.7	0.2	1.4	0.2	0	0.7
Herbaceous legumes																				
Lucerne	10.2	1.9	2.1	2.8	5.4	18.2	1.7	3.5	0.7	0.5	0	4.5	0.7	0.2	3.3	0.5	4.0	2.4	5.2	5.0
Desmodium	4.5	1.2	2.4	1.7	3.8	10.6	1.7	1.9	0.9	0.5	0.2	5.4	0	0.9	1.4	0.2	2.1	2.1	8.0	3.1
Lupine	0.5	0.9	0.7	0.5	1.2	0.7	0.2	0.7	0.2	0.2	0	0.5	0.2	0	1.2	0	0.5	0.2	0	1.2
Purple vetch	0	0.5	0	0.2	0	0.2	0	0.5	0	0	0	0.7	0	0	0.2	0.2	0.2	0.7	0	0.2
Lablab	0	0.2	0.2	0	0.2	1.2	0	0.5	0	0	0	0	0	0	0.2	0	0.5	0	0	0.2
Conserved feeds																				
Conservation	15.8	4.5	6.1	1.2	11.3	18.9	4.3	11.1	0.9	2.6	0.5	11.3	4.0	2.4	5.7	0.9	6.4	2.1	16.1	8.3
Silage	16.1	4.7	5.4	1.7	9.7	21.5	4.7	10.4	0.5	1.9	0.9	10.2	5.4	1.7	6.6	0.9	8.3	6.1	20.8	11.6
Hay	11.3	3.3	3.5	1.4	8.0	18.2	3.8	4.7	0.7	1.2	0	6.9	2.8	1.4	4.3	0.5	6.9	3.3	15.8	10.6
Fodder trees/shrubs																				
Fodder shrubs	14.9	6.1	3.1	2.1	9.9	17.5	2.8	2.6	0	1.7	0.5	5.2	1.4	0.7	5.0	0.5	4.5	1.7	11.1	4.0
Tree Lucerne	2.6	1.9	0.7	1.4	1.7	3.5	0.7	0.9	0	0.7	0.2	0.9	0.7	0	0.5	0	1.4	0.2	6.6	1.7
Fodder grain crops																				
Sorghum	7.3	1.2	2.4	1.9	5.4	12.1	1.4	2.8	0.9	1.2	0.2	3.3	0	0.7	2.1	0.2	3.1	1.7	3.5	3.5
Oats	4.3	0.5	2.1	1.4	2.4	4.0	2.4	2.6	0.2	0.2	0.2	2.6	0.7	0.2	0.9	0	1.4	1.4	3.3	1.7
Root crops																				
S.P vines	8.7	1.4	2.8	1.7	5.9	8.0	1.7	7.8	0.7	2.1	1.4	7.1	1.9	1.9	1.7	1.4	4.7	1.2	7.3	2.8
Edible cana	0	0	0	0	0	0	0	0.2	0.2	0	0	0	0	0	0	0.2	0	0	0.2	0
Other feeds																				
Mineral	11.8	2.6	4.0	1.2	10.9	15.4	4.7	10.4	12.8	5.0	1.7	32.6	5.9	4.0	5.0	1.7	6.4	1.9	19.6	9.7
Concentrates	9.9	3.5	4.0	2.1	7.8	14.7	5.0	8.7	11.8	4.5	1.9	25.5	4.7	2.8	5.2	1.4	4.7	1.4	17.0	7.8
Feed form	10.6	3.1	4.7	0.9	6.1	16.5	3.3	4.0	0.5	1.4	0.2	8.7	3.3	1.9	5.4	0.5	5.4	2.4	11.3	8.3

Abbreviations: MoA (Ministry of Agriculture, Livestock and Fisheries Development), NGO (Non-Governmental Organization), FO (Farmer Organizations), SF (Skilled Farmers), Neighb (Neighbours), ID (Input Dealers), PSP (Private Service Providers), MP (Mobile Phone), TV (Television), NP (Newspapers), WM (Written Materials), Int (Internet), EV (Exchange Visits), Demo (Demonstrations), FD (Field Days), ASK (Agricultural Shows of Kenya)

3.4 Preferred sources of information

Results in Table 17 show how farmers scored various information sources as high-, medium- or low-preference sources. The total score and overall rank show preference in terms of quality and extent of use of different sources. The average score presented in the table shows the average preference of those farmers rating a particular source. Considering the total scores and overall rank, CESP were the most preferred source of information by the sampled farmers, who largely depend on them to access information on livestock feeds. CESP provide opportunities for face-to-face communication and respond to farmers' questions almost immediately. Radio and MoALFD were ranked the 2nd and 3rd most preferred sources respectively. Neighbours, farmer cooperatives, field days, VFTs, input dealers and agricultural shows were also ranked among the top 10 preferred sources.

The average score for sources used by more than 20 farmers show that CESP received the highest average score of 2.34 out of 3, followed by MoAFLD staff and field days. VFTs ranked 10th on average score among the 13 sources used by more than 20 farmers, indicating that while some farmers found them useful, others did not. Among sources used by more than 20 farmers, those with the lowest scores were exchange visits, farmer cooperatives and skilled farmers. The low scores for skilled farmers and exchange visits may indicate that the farmers visited are at too high a level to provide information that is useful for the visiting farmers. Differentiating by gender, Table 18 reveals that female farmers who used CESP rated them about the same as male farmers (average scores of 2.36 vs. 2.32, respectively). Both male and female farmers had CESP and radio as their 1st and 2nd preferred sources of information, respectively. Differences however emerged in the third preference of information source with male farmers preferring MoALFD and female farmers preferring neighbours. Relative to other sources, the VFTs were ranked 7th by male farmers and 8th by female farmers.

Differences between males and females in preferences were significant for only three of the 23 sources. Women had lower preferences for field days and agricultural shows than men, perhaps because these often involve travelling away from the farm for an extended period. Men had less preference for input dealers than women, though the difference was only marginally significant ($P < 0.10$).

Farmers' preference for information sources varied across sites as presented in Table 19. Radio, CESP and MoALFD formed the most preferred sources of information in all the sites. The table further shows that CESP were mostly preferred in Sot, Cherang'ani and Tanykina. MoALFD was preferred in Cherang'ani, Sot and Kieni while radio was mostly preferred by farmers in Tanykina, Olkalou and Kapcheno sites. VFTs received relatively low scores in Metkei, Taragoon and Tanykina.

Table 17: Farmers preferences among different sources of information

Source	Low preference (1)	Medium preference (2)	High preference (3)	Total frequency	Total score	Average score	Overall rank on total score
CESPs	35(35)	49(98)	96(288)	180	421	2.34	1 st
Radio	50(50)	71(142)	56(168)	177	360	2.03	2 nd
MoALFD	25(25)	44(88)	64(192)	133	305	2.29	3 rd
Neighbours	37(37)	49(98)	39(117)	125	252	2.02	4 th
Farmer cooperatives	56(56)	29(58)	25(75)	110	197	1.79	5 th
Field days	19(19)	26(52)	42(126)	87	189	2.17	6 th
VFTs	21(21)	33(66)	12(36)	66	123	1.86	7 th
Input dealers	15(15)	13(26)	21(63)	49	104	2.12	8 th
Skilled farmers	20(20)	19(38)	11(33)	50	91	1.82	9 th
Agricultural shows	13(13)	14(28)	5(15)	32	62	1.94	10 th
NGO	7(7)	8(16)	13(39)	28	56	2	11 th
Exchange visit	16(16)	6(12)	7(21)	29	49	1.69	12 th
Private service providers	7(7)	7(14)	8(24)	22	45	2.05	13 th
TV	8(8)	7(14)	3(9)	18	33	1.83	14 th
Written material	9(9)	5(10)	4(12)	18	31	1.72	15 th
Farmer organizations	3(3)	9(18)	4(12)	16	31	1.94	16 th
Research Institutions	4(4)	8(16)	2(6)	14	26	1.86	17 th
Mobile phone	3(3)	3(6)	5(15)	11	24	2.18	18 th
Breeders show	7(7)	2(4)	3(9)	12	20	1.67	19 th
Internet	2(2)	3(6)	2(6)	7	14	2	20 th
Newspapers	7(7)	1(2)	0(0)	8	9	1.12	21 st
Demonstrations	3(3)	3(6)	0(0)	6	9	1.5	22 nd
Posters	1(1)	0(0)	0(0)	1	1	1	23 rd

Figures in parenthesis present the scores; Total frequency is the sum of frequency of farmers who rated the sources

Table 18: Preferred sources of information by gender

Source	Male farmers				Female farmers			Overall rank on total score
	Total frequency	Total score	Average score	Overall rank	Total frequency	Total score	Average score	
CESPs	93	216	2.32	1	87	205	2.36	1
Radio	96	195	2.03	2	81	165	2.04	2
MoALFD	75	179	2.39	3	54	116	2.15	4
Field days	75	137	1.83	4	28***	52	1.86	7
Neighbours	64	124	1.94	5	61	128	2.1	3
Farmer cooperatives	45	98	2.18	6	42	99	2.36	5
VFTs	39	73	1.87	7	27	50	1.85	8
Skilled farmers	29	52	1.79	8	21	39	1.86	9
Agricultural shows	24	45	1.88	9	8**	12	1.5	16
Input dealers	21	44	2.1	10	35*	59	1.69	6
Exchange visit	16	29	1.81	11	13	22	1.69	12
NGO	15	27	1.8	12	13	33	2.54	10
Private service providers	10	20	2	13	12	25	2.08	11
TV	10	19	1.9	14	8	12	1.5	17
Written material	10	18	1.8	15	8	13	1.63	14
Farmer organizations	8	16	2	16	8	17	2.13	13
Breeders show	9	13	1.44	17	3	7	2.33	19
Research Institutions	6	13	2.17	18	8	13	1.63	15
Mobile phone	5	12	2.4	19	6	12	2	18
Internet	5	8	1.6	20	2	6	3	20
Demonstrations	5	8	1.6	21	1	1	1	22
Newspapers	5	6	1.2	22	3	3	1	21
Posters	1	1	1	23	0	0	0	23

Total score is the sum of scores for each preference. Scores were got by multiplying frequencies on each preference level by scores assigned where low preference was given a score of 1, medium a score of 2 and high a score of 3. Asterisks indicate significant differences between men and women in total frequency (***p<0.01, **p<0.05,*p<0.1).

Table 19: Farmers ranking on preferred sources of information by site

	Cherang'ani (N=61)	Tanykina (N=131)	Kapcheno (N=34)	Metkei (N=19)	Olkalou (N=67)	Taragoon (N=19)	Sot (N=60)	Kieni (N=32)
	Total frequency (Total score)	Total frequency (Total score)	Total frequency (Total score)	Total frequency (Total score)	Total frequency (Total score)	Total frequency (Total score)	Total frequency (Total score)	Total frequency (Total score)
CESPs	(41)99*	(27)68	(11)21	(11)24	(19)41	(5)14	(52)132	(14)22
MoALFD	(32)83	(10)21	(8)16	(5)15	(13)36	(8)15	(31)58	(22)59
Field days	(25)41	(45)81	(11)18	(9)17	(10)16	(5)10	(3)4	(2)2
Neighbours	(15)21	(67)143	(15)38	(5)11	(14)22	(1)1	(5)9	(3)7
VFTs	(12)24	(3)6	(8)11	(0)0	(11)23	(1)1	(19)33	(12)22
Skilled farmers	(12)17	(12)21	(4)10	(3)5	(13)25	(4)9	(2)4	(0)0
Farmer cooperatives	(6)15	(40)93	(0)0	(3)7	(13)26	(2)2	(12)30	(11)24
Radio	(7)12	(70)158	(22)44	(8)15	(28)63	(6)14	(26)37	(10)17
Exchange visit	(7)9	(10)17	(1)1	(1)3	(2)5	(2)5	(5)6	(1)3
Research Institutions	(10)7	(0)0	(0)0	(1)2	(3)7	(0)0	(0)0	(0)0
Agricultural shows	(4)7	(19)31	(1)2	(1)2	(3)7	(2)5	(1)1	(1)1
Breeders show	(3)7	(4)6	(0)0	(1)1	(4)6	(0)0	(0)0	(0)0
NGO	(2)3	(0)1	(13)33	(0)0	(5)11	(0)0	(4)9	(4)6
Internet	(2)3	(1)3	(0)0	(0)0	(2)4	(0)0	(0)0	(0)0
Private service providers	(2)2	(2)2	(0)0	(0)0	(5)10	(3)5	(8)21	(2)5
Written material	(1)3	(5)8	(1)1	(0)0	(5)11	(0)0	(2)4	(1)2
Input dealers	(1)2	(16)33	(1)1	(0)0	(24)54	(3)8	(2)2	(2)4
Farmer organizations	(0)0	(3)6	(0)0	(0)0	(3)6	(4)10	(4)7	(2)4
TV	(0)0	(10)20	(3)3	(1)1	(3)5	(1)2	(0)0	(0)0
Mobile phone	(0)0	(7)18	(0)0	(1)2	(3)4	(0)0	(0)0	(0)0
Newspapers	(0)0	(2)2	(0)0	(0)0	(1)1	(0)0	(0)0	(0)0
Demonstrations	(0)0	(2)4	(0)0	(0)0	(3)4	(1)1	(0)0	(0)0
Posters	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

*The highest score indicates the highest rank. Calculation of scores is explained in the note to Table 18.

3.4.1 Frequency of use, reliability, accessibility and affordability of preferred sources of information compared to the VFTs

The reliability, frequency of contact, accessibility and affordability of the three most preferred sources of information and the VFTs were determined. Farmers scored the aspects on a scale of 1 to 5 where 5 was highest and 1 was lowest. The mean score was then calculated to determine farmers' perception of the extent of reliability, frequency of contact, accessibility and affordability of the sources. The results are as presented in Table 20. CESP's had high average scores on reliability and affordability. CESP's, MoALFD and VFTs all scored highly on reliability of their information. VFTs and CESP's scored highest on frequency of use, reflecting their close physical location to farmers. MoALFD on the other hand scored low on frequency of contact. Radio, VFTs and CESP's scored highly on accessibility and affordability as compared to MoAFLD. Against the four criteria, CESP's and VFTs achieved the highest scores. The scores on reliability, frequency, accessibility and affordability of VFTs (Table 20), which are very high, appear to be somewhat inconsistent with VFT's average preference scores, which are somewhat lower (Table 18). Even though VFTs are viewed as reliable, accessible and affordable, according to Table 20, they advise on fewer topics than do the other sources and that may explain their low score on preference.

Table 20: Mean scores on reliability, frequency, accessibility and affordability of preferred sources of information compared to the VFTs

Source	N	Reliability	Frequenc y	Accessibilit y	Affordabilit y	Overall mean score
CESP's	180	4.6 ^a	4.1	4.4	4.6	4.4
Radio	177	4.0	3.7	4.5	4.6	4.2
MoALFD	133	4.5	2.9	3.4	3.6	3.6
VFTs	66	4.5	4.2	4.5	4.5	4.4

^a5=highly, 4=high, 3=moderate, 2=low, 1=lowest

The reliability, frequency, accessibility and affordability of preferred sources were examined by gender (Table 21). Both male and female farmers awarded almost similar scores to CESP's and radio in terms of their reliability, frequency, accessibility and affordability. Male farmers considered MoALFD to be highly reliable but not very easy to contact, access and afford. Female farmers scored their neighbours highly in all aspects. Overall, CESP's had the highest score among male farmers, while neighbours took the lead among female farmers. There were no significant differences in reliability, frequency, accessibility and affordability of preferred sources between male and female farmers.

Table 21: Reliability, frequency, accessibility and affordability of preferred sources of information and VFTs by gender

	Source	N	Reliability	Frequency	Accessibilit y	Affordability	Overall mean score
Male	CESPs	93	4.5 ^a	4.3	4.4	4.7	4.5
	Radio	96	4.0	3.5	4.3	4.4	4.1
	MoALFD	75	4.6	2.5	3.3	3.6	3.5
	VFTs	40	4.5	4	4.3	4.5	4.3
Female	CESPs	87	4.6	4	4.5	4.6	4.4
	Radio	81	4.1	3.9	4.8	4.7	4.4
	Neighbours	61	4.7	4.6	4.6	4.7	4.7
	VFTs	26	4.5	4.4	4.5	4.6	4.5

^a5=highly, 4=high, 3=moderate, 2=low, 1=lowest

3.5 Training on livestock feed technologies

Table 22 present the results of the persons trained in the household. Farmers were asked to state if any member of the household had ever received training on livestock feed technologies from any source. About 60% of farmers trained were household heads and 25.2% were spouses. Attendance of trainings by the household heads is useful in improving their farm practices. Occasionally, some farmers do let their workers attend training workshops, especially in households where the head and spouse are frequently absent.

Table 22: Household members who have ever received training from any source

Person Trained	N	Percentage
Head	270	60
Spouse	113	25.2
Farm worker	9	2
Son	10	2.2
None	47	10.5
Total (N)	449	100

About 88.9% of the farmers had been trained on livestock feed technologies. Of the male farmers, 90.1% were trained, while of the female farmers, 87.4% were trained. More than 50% of trained farmers reported to have been trained on Napier grass, silage making, Rhodes grass, mineral supplementation, conservation of crop residues and concentrates (Table 23). Significant differences in percentages of farmers trained were recorded in only two technologies, that is, lucerne and desmodium. However, results show that women received training in similar technologies as men but at slightly lower rates, except for mineral

supplementation. Overall, less than 10% of farmers had been trained on tree Lucerne and Columbus grass.

Table 23: Training on livestock feed technologies by gender

Feed technology	% male (N=210)	% female (N=166)	% total (N=376)
Grasses			
Napier grass	79.0	74.7	77.1
Rhodes grass	59.7	55.8	57.9
Columbus grass	5.6	3.7	4.7
Giant setaria	4.3	2.6	3.5
Herbaceous legumes			
Lucerne	36.9	26.3**	32.2
Desmodium	24.0	16.3*	20.6
Lupine	4.7	2.6	3.8
Purple vetch	1.3	1.6	1.4
Lablab	1.3	1.1	1.2
Conserved feeds			
Silage making	63.5	58.4	61.2
Conservation of crop residues	54.1	51.6	53.0
Hay baling	41.6	37.9	40.0
Fodder trees and shrubs			
Fodder shrubs	45.5	46.3	45.9
Tree Lucerne	7.7	10.0	8.7
Other fodder crops			
Sweet potato vines	30.0	29.5	29.8
Sorghum	26.2	22.6	24.6
Oats	18.0	13.2	15.8
Mulberry	3.0	2.1	2.6
Edible cana	1.7	1.6	1.7
Other feeds			
Mineral supplementation	53.6	58.9	56.0
Concentrates	51.9	47.9	50.1
Feed formulation	37.3	36.8	37.1

***p<0.01, **p<0.05, *p<0.1

Further analysis however shows that 92.1% of women in male-headed household received training whereas 69.2% of women in female-headed households did. The difference was highly significant ($p<0.01$). Whereas, male and female farmers received training in about equal measure, women in female-headed households received far less training than men and women in male-headed households (Table 24). A significantly higher percentage of women in male-headed households received training on conservation of crop residues and oats than women in female-headed households.

Table 24: Disparities in training on livestock feed technologies between women in male-headed households and women in female-headed households

Type of technology	% women in female-headed households (N=27)	% female in male headed households (N=139)
Grasses		
Napier grass	77.8	70.5
Rhodes grass	48.1	46.8
Columbus grass	3.7	0.7
Giant setaria	3.7	0.7
Herbaceous legumes		
Lucerne	22.2	16.5
Desmodium	22.2	9.4
Purple vetch	0.0	1.4
Lablab	0.0	0.7
Lupine	0.0	0.7
Conserved feeds		
Silage making	55.6	45.3
Conservation of crop residues	33.3	45.3*
Hay baling	22.2	30.9
Fodder trees and shrubs		
Fodder shrubs	48.1	33.1
Tree Lucerne	3.7	7.2
Other fodder crops		
Sweet potato vines	14.8	18.7
Sorghum	22.2	17.3
Oats	11.1	6.5*
Mulberry	3.7	0.0
Other feeds		
Mineral supplementation	37.0	39.6
Concentrates	37.0	32.4
Feed formulation	37.0	26.6

***p<0.01, **p<0.05,*p<0.1

Farmers from all sites received training in most livestock feed technologies. Napier grass appeared to be the technology with the highest proportion of farmers trained, except in Taragoon where it came second after silage making (Table 25). Unlike other sites, most farmers in Metkei and Olkalou stated that they had been trained on oats because it is one of the major livestock feeds used in the areas. Generally, farmers in all sites reported not having been trained on at least two technologies. This is logical as some technologies are not relevant in some agro-ecological zones.

In the present study, farmers received training from several sources: CESP (56.7%), neighbours (46.3%), MoAFLD (38.1%), input dealers (18.9%), self-experience (17%), VFTs (10.9%), NGO (10.1%), FTC (9.9%), KARI (6.4%) and ASK (3.1%). Overall, most trainings

were on Napier grass, Rhodes grass, mineral supplementation, concentrates, silage making, conservation of crop residues and fodder shrubs (Table 26). Different institutions emphasized different topics in their training. CESP, MoALFD and neighbours featured as the most dominant institutions offering training on Napier grass. Others like NGOs put emphasis on fodder shrubs and sorghum.

The study sought to understand the frequency of training by institutions in the past six months. Frequencies were captured in six aspects. “Not so often” referred to institutions that offered few training sessions, that is, once to three times in the past six months while “very often” referred to institutions that conducted training at least every week. Asked about how many times they had been trained in the past six months, sources that emerged top in training farmers included CESP, neighbours, and MoALFD staff in terms of numbers of farmers receiving training and neighbours, CESP and VFTs in terms of frequency of training (Table 27). About 47.5% had received training very often or more than once per month from neighbours, 45.4% from CESP and 39.1% from VFTs. Few farmers received periodic training from MoALFD and NGOs. The results coincide with earlier findings that indicated low frequency of contact between farmers and MoALFD. Non-governmental organizations on the other hand had low frequency probably because they only operated when their projects were running. Additionally, about 40% of the farmers received training once from research institutes and the ASK.

Table 25: Percentage of farmers trained on livestock feed technologies by site

Feed Technology	Cherang'ani (N=61)	Tanykina (N=131)	Kapcheno (N=34)	Metkei (N=19)	Olkalou (N=67)	Taragoon (N=19)	Sot (N=60)	Kieni (N=32)
Grasses								
Napier grass	88.5	74.0	85.3	63.2	50.7	57.9	100	90.6
Rhodes grass	78.7	66.4	26.5	42.1	14.9	42.1	98.3	50.0
Columbus grass	4.9	6.1	0.0	5.3	1.5	15.8	1.7	9.4
Giant setaria	16.4	0.8	0.0	0.0	1.5	5.3	1.7	3.1
Herbaceous legumes								
Lucerne	45.9	27.5	17.6	15.8	16.4	42.1	58.3	28.1
Desmodium	34.4	9.9	2.9	5.3	6.0	15.8	63.3	18.8
Purple vetch	0.0	0.0	0.0	5.3	4.5	5.3	0.0	3.1
Lablab	3.3	0.0	0.0	0.0	3.0	0.0	1.7	0.0
Lupine	13.1	1.5	0.0	0.0	3.0	10.5	1.7	3.1
Fodder shrubs and trees								
Fodder shrubs	60.7	24.4	44.1	31.6	38.8	47.4	88.3	50.0
Tree Lucerne	23.0	3.8	11.8	10.5	6.0	5.3	10.0	3.1
Conserved feeds								
Silage making	77.0	61.8	23.5	42.1	50.7	68.4	75.0	71.9
Conservation of crop residues	68.9	52.7	44.1	21.1	20.9	42.1	93.3	50.0
Hay baling	68.9	30.5	14.7	26.3	20.9	36.8	71.7	40.6
Other fodder crops								
Sorghum	34.4	13.7	0.0	15.8	11.9	10.5	81.7	9.4
Oats	34.4	0.8	0.0	52.6	26.9	42.1	13.3	3.1
Edible cana	1.6	0.8	0.0	5.3	0.0	5.3	0.0	9.4
Sweet potato vines	62.3	15.3	11.8	5.3	4.5	15.8	76.7	34.4
Mulberry	4.9	0.8	0.0	0.0	1.5	0.0	10.0	0.0
Other feeds								
Feed formulation	54.1	34.4	17.6	26.3	25.4	52. ³	58.3	18.8
Concentrates	65.6	53.4	52.9	36.8	16.4	31.6	78.3	40.6
Mineral supplementation	75.4	55.0	58.8	42.1	23.9	36.8	83.3	56.3

Table 26: Percentage of farmers trained on livestock feed technologies by institution

Feed technology	CESPs N=240	Neighbours N=196	MoALFD N=161	Input dealers N=80	Self* N=72	VFT N=46	NGO N=43	FTC N=42	KARI N=27	ASK N=14
Grasses										
Napier grass	39.7	25.5	24.1	2.6	11.1	5.7	5.7	5.7	2.4	1.4
Rhodes	31.2	17.3	16.8	3.5	4.5	4.5	2.1	4.3	2.1	0.7
Columbus grass	1.7	0.9	1.2	0.5	0	0.2	0	0.2	0	0
Giant setaria	0.9	0.5	0.7	0.5	0.2	0.5	0.7	0	0	0
Herbaceous legumes										
Lucern	18.4	4.5	8.5	1.7	0.7	0.7	2.6	1.4	1.2	0.9
Desmodium	12.8	1.9	5.9	1.4	0.2	0.5	1.7	0.2	0.9	0
Purple vetch	0.5	0.2	0.2	0	0	0	0.2	0.2	0	0.2
Lablab	0.2	0.2	0	0	0	0	0	0	0	0
Lupine	1.2	1.2	0	0.2	0	0.5	0.7	0	0.5	0.2
Fodder shrubs and trees										
Fodder shrubs	25.8	4.7	14.9	0	1.9	5.7	5.9	1.4	1.4	0.9
Tree lucern	3.5	1.2	2.4	0	0.2	0.5	1.2	0	0.5	0
Conserved feeds										
Silage	30.7	16.3	17.0	0.7	1.4	3.1	5.2	3.5	1.4	1.9
Conservation of crop residues	27.4	13.2	17.3	1.2	5.2	4.3	4.5	2.8	1.4	0.5
Hay baling	23.2	6.1	12.3	0.7	0.7	4.0	3.3	1.9	1.4	0.7
Other fodder crops										
Sorghum	15.8	3.3	6.9	0.9	0.5	1.4	1.7	0.9	0.5	0
Oats	6.9	2.4	3.8	0.7	0	1.9	0.7	0.5	1.2	0.5
Edible cana	0.2	0.2	0.2	0	0	0	0.2	0.2	0.2	0
Sweet potato vines	11.8	6.9	9.2	0.2	1.2	4.5	1.4	1.9	1.2	0.5
Mulberry	0.2	0.7	0	0.2	0.2	0.5	0	0	0	0
Other feeds										
Concentrates	18.4	12.3	10.4	10.2	5.9	3.3	3.1	5.0	2.4	1.2
Feed formulation	21.7	6.9	11.6	0.9	2.6	2.6	2.1	2.1	0.7	0
Mineral supplementation	20.8	13.7	14.9	11.3	5.0	5.0	3.3	6.1	2.1	0.7

N=number of farmers trained by a particular institution; *self means learning through one's own experimentation

Table 27: Percentage of farmers reporting on frequency of training by institutions in the past six months

No. of times trained	CESPs N=240	Neighbours N=196	MoALFD N=161	Input dealers N=80	Self N=72	VFT N=46	NGO N=43	FTC N=42	KARI N=27	ASK N=13
Not so often	15.8	20.4	40.4	38.8	27.8	23.9	46.5	28.6	33.3	30.8
Once	18.3	19.4	32.3	11.3	18.1	17.4	14	31	48.1	46.2
Twice	12.1	6.6	13.7	11.3	8.3	6.5	14	21.4	7.4	15.4
Thrice	8.3	6.1	0.6	8.8	1.4	13	4.7	11.9	0	7.7
Every month	20	10.7	10.6	7.5	5.6	21.7	7.0	4.8	0	0
Every two weeks	3.3	4.1	0.6	1.3	0	0	0	0	0	0
Very often	22.1	32.7	1.9	21.3	38.9	17.4	14	2.4	11.1	0

3.6 Technology sharing/multiplier effect

From earlier discussions (Table 22) it was reported that 90% of farmers were trained. Further analysis was conducted to find out whether farmers shared information with others about the technologies they had been trained on. About 72% of the trained farmers did share information signifying the role of farmers in information dissemination. However, the proportion of male farmers (76.8%) who shared information was significantly higher ($p < 0.05$) compared to that of female farmers (66.3%). Disaggregating by gender, 76.8% of male farmers reported that they shared information on the technologies trained whereas 66.3% of female farmers did. Both male and female farmers shared a mean of 3.5 technologies. No significant differences were detected across the two genders. Women from female-headed households (69.5%) shared information on the new technologies with fellow farmers more than did women from male-headed households (53.8%). The difference was marginally significant at $p < 0.1$. The mean number of technologies shared was not significantly different between the two categories with female-headed households sharing 3.62 technologies and women in male-headed households sharing 3.47 technologies.

Table 28 shows number of technologies on which information has been shared. About 27.9% of farmers did not share information on livestock feed technologies with other farmers. However, 23.2% of the farmers did share information on three different livestock feed technologies. About 12.1% and 12.5% of the farmers shared two and four technologies, respectively. With regard to gender, male farmers shared information on a maximum of 10 technologies, higher than a maximum of 7 technologies shared by female farmers.

Table 28: Number of technologies shared by farmers

Number of technologies shared	Male farmers (N=233)		Female farmers (N=190)		Total (N=423)	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
0	54	23.2	64	33.7	118	27.9
1	26	11.2	8	4.2	34	8
2	29	12.5	22	11.8	51	12.1
3	58	24.9	40	21.1	98	23.2
4	25	10.7	28	14.7	53	12.5
5	17	7.3	14	7.4	31	7.3
6	6	2.6	10	5.3	16	3.8
7	9	3.9	4	2.1	13	3.1
8	4	1.7	0	0	4	0.9
9	2	0.9	0	0	2	0.5
10	3	1.3	0	0	3	0.7
Total	233	100	190	100	423	100

There were more women from female-headed households that did not share any technology compared to those in male-headed households (Table 29). The highest number of technologies shared was three for women in both households. Only 2.6% and 2% of the female farmers from female-headed households and male-headed households shared information on 7 technologies.

Table 29: Number of technologies shared by trained women

Number of technologies shared	Women in female-headed households (N=39)		Female in male-headed households (N=151)	
	Frequency	Percent	Frequency	Percent
0	18	46.2	46	30.5
1	2	5.1	6	4
2	3	7.7	19	12.6
3	6	15.4	34	22.5
4	4	10.3	24	15.9
5	3	7.7	11	7.3
6	2	5.1	8	5.3
7	1	2.6	3	2
Total	39	100	151	100

There was considerable variation among sites in the proportion of farmers sharing information with other farmers. Nearly all (98%) farmers in Sot shared information (Table 30). More than 80% did so in Cherang'ani and Kieni. Information sharing was low among farmers in Olkalou and Taragoon, which could be pegged perhaps to their big farm size, sparse population and long distance between farmers' households.

Table 30: Percentage of farmers sharing information by site

Site	N	% farmers
Sot	56	98.3
Cherang'ani	85	91.8
Kieni	27	87.5
Kapcheno	10	79.4
Taragoon	27	68.4
Tanykina	13	64.9
Metkei	59	52.6
Olkalou	28	40.3

3.6.1 Types of feed technologies shared by gender

As can be seen in Table 31, the top three shared technologies were Napier grass (75.4%), conservation of crop residues (46.9%) and mineral supplementation (39.3%). There were few differences between genders. A greater percentage of female farmers shared information on Napier grass and mineral supplementation than male farmers who disseminated information on Lucerne more than women did.

The least shared technologies were edible cana and lupine. This could be because farmers did not have adequate understanding of these feeds. In fact, the previous findings showed that less than 5% of farmers interviewed across sites had accessed information on these feeds and less than 5% of farmers were trained on them. Similar results were reported by Kiptot and Franzel (2012).

Table 31: Types of feed technologies shared by farmers

Feed technology	N	% male (N=179)	% female (N=126)	% total (N=305)
Grasses				
Napier grass	230	71.5	81.0*	75.4
Rhodes grass	113	37.4	36.5	37.0
Columbus grass	4	0	3.2**	1.3
Giant setaria	0	0	0	0
Herbaceous legumes				
Lucerne	33	14.5	5.6**	10.8
Desmodium	20	7.8	4.8	6.6
Purple vetch	2	1.1	0.0	0.7
Lablab	2	1.1	0.0	0.7
Lupine	1	0.6	0.0	0.3
Fodder shrubs and trees				
Fodder shrubs	50	16.8	15.9	16.4
Tree Lucerne	3	1.7	0.0	1.0
Conserved feeds				
Conservation of crop residues	143	45.3	49.2	46.9
Silage making	57	20.7	15.9	18.7
Hay baling	34	12.3	9.5	11.1
Other fodder crops				
Sweet potato	68	20.7	24.6	22.3
Oats	23	8.4	6.3	7.5
Sorghum	17	5.6	5.6	5.6
Edible cana	1	0.6	0.0	0.3
Other feeds				
Mineral supplementation	120	34.1	46.8**	39.3
Concentrates	83	27.9	26.2	27.2
Feed formulation	49	16.2	15.9	16.1

***p<0.01, **p<0.05,*p<0.1

Results in Table 32 show a mixed pattern on information sharing between women in male and female-headed households with the latter leading in nine technologies and the former in six. Significant differences were recorded on only two technologies: sorghum and conservation of crop residues.

Table 32: Types of feed technologies shared by women farmers

Feed technology	% women in female-headed households (N=21)		% female in male-headed households (N=105)	
	N		N	
Grasses				
Napier grass	18	85.7	84	80
Rhodes grass	8	38.1	38	36.2
Columbus grass	0	0	4	3.8
Giant setaria	0	0	0	0
Herbaceous legumes				
Lucerne	2	9.5	5	4.8
Desmodium	0	0	6	5.7
Purple vetch	0	0	0	0
Lablab	0	0	0	0
Lupine	0	0	0	0
Fodder trees and shrubs				
Fodder shrubs	3	17.6	13	13.9
Tree lucern	0	0	0	0
Conserved feeds				
Conservation of crop residues	6	28.6	56	53.3**
Silage making	2	9.5	18	17.1
Hay baling	3	14.3	9	8.6
Other fodder crops				
Sweet potato vines	4	19.0	27	25.7
Oats	2	9.5	6	5.7
Sorghum	4	19.0	3	2.9***
Edible cana	0	0	0	0
Other feeds				
Mineral supplementation	7	33.3	52	49.5
Concentrates	8	38.1	25	23.8
Feed formulation	5	23.8	15	14.3

***p<0.01, **p<0.05,*p<0.1

3.7 Livestock feed technologies practised

Presented in Table 33 are the results of livestock feed technologies that farmers have tried to practise in their lifetime. The study assumed that feed technologies practised depend on the individuals as opposed to household heads. In general, the three most frequently practised technologies were mineral supplementation, Napier grass and concentrates. This was similar for both male and female farmers. As a matter of fact, the proportions using the top 10 technologies did not vary much except that there were significantly more men practising Rhodes grass and desmodium feed technologies than women.

Table 33: Technologies practised by gender

Feed technology type	% male (N=233)	% female (N=190)	% total (N=423)
Grasses			
Napier grass	82.0	81.6	81.3
kikuyu grass	47.6	47.4	47.5
Rhodes grass	43.3	30.0***	37.4
Rye grass	3.4	5.8	4.5
Giant setaria	0.9	2.6	1.4
Columbus grass	0.9	1.6	1.2
Herbaceous legumes			
Lucerne	10.3	5.3*	8.0
Desmodium	8.6	1.3***	5.2
Purple vetch	3.0	1.6	2.4
Lupine	1.7	0.7	1.2
Lablab	1.3	1.3	1.2
Fodder shrubs and trees			
Fodder shrubs	16.3	13.7	14.7
Tree Lucerne	3.4	2.6	2.8
Conserved feeds			
Conservation of crop residues	52.4	56.8	54.4
Silage making	15.5	13.7	14.7
Hay baling	13.3	14.2	13.7
Other fodder crops			
Sweet potato vines	20.6	17.4	19.1
Oats	18.0	12.6	15.6
Sorghum	9.4	10.0	9.7
Edible cana	2.1	0.0*	1.2
Other feeds			
Mineral supplementation	100	100	100
Concentrates	52.8	58.4	55.3
Feed formulation	13.7	17.9	15.6

***p<0.01, **p<0.05,*p<0.1

There were few differences between female farmers in male-headed and female-headed households. Conservation of crop residues was practised more by female farmers in male-headed households than single women. However, single women surpassed women in male-headed households in using sorghum and rye grass (Table 34).

Table 34: Technologies practised by female heads and women in male-headed households

Technology practised	% female-headed households (N=39)	% female in male-headed households (N=151)
Grasses		
Napier grass	74.4	82.8
Kikuyu grass	35.9	50.3
Rhodes grass	23.1	31.8
Rye grass	12.8	4.0**
Giant setaria	0	2.6
Columbus grass	2.6	1.3
Herbaceous legumes		
Lucerne	7.7	4.6
Desmodium	0	1.3
Purple vetch	2.6	1.3
Lablab	0	1.3
Lupine	0	0.7
Fodder shrubs and trees		
Fodder shrubs	10.3	13.9
Tree Lucerne	0	2.6
Other fodder crops		
Sweet potato vines	10.3	19.2
Oats	17.9	11.3
Sorghum	20.5	7.3**
Conserved feeds		
Conservation of crop residues	35.9	62.3***
Silage making	7.7	15.2
Hay baling	17.9	13.2
Other feeds		
Mineral supplementation	100	100
Concentrates	59.0	58.3
Feed formulation	15.4	18.5

***p<0.01, **p<0.05,*p<0.1

Analysis of livestock feed technologies practised by site shows considerable variation across regions (Table 35). Majority of the farmers (>85%) in the UM areas of Rift Valley, mainly Tanykina and Kapcheno sites in Nandi county, used kikuyu grass, which is natural and common in the area. Similar findings were reported in Olkalou and Metkei sites in UH areas of Rift valley. In addition to that, farmers in Olkalou and Metkei also used oats for feeding their livestock. It can be said that farmers use feeds that are available locally. Furthermore, most of the farmers in these sites had relatively large farm sizes that could have slowed down the adoption of intensive technologies in favour of the free grazing system characterized by use of natural grass. This is why, contrary to these indications, farmers in Cherang'ani, an UM area and those from Kieni, a LM area, used Napier grass more than kikuyu grass. Cherang'ani and Kieni farmers own relatively small land sizes and are therefore likely to adopt intensive livestock feeding technologies such as silage and hay that are suitable for the confined grazing system. In LH areas, particularly Sot and Taragoon, the commonly used livestock feed technologies were conservation of crop residues and Napier grass. This was so perhaps because the region receives slightly less rain and therefore farmers tend to use feeds with long storage life span. The use of herbaceous legumes was relatively low in all sites. Fodder shrubs were common in Kapcheno, Sot and Kieni areas, but were not used in Metkei.

Table 35: Technologies practised by farmers by site

Feed technology	Total (N=423)	Cherang'ani (N=56)	Tanykina (N=85)	Kapcheno (N=27)	Metkei (N=10)	Olkalou (N=27)	Taragoon (N=13)	Sot (N=59)	Kieni (N=28)
Grasses									
Napier grass	81.6	95.1	70.2	88.2	78.9	76.1	47.3	96.7	100
kikuyu grass	81.1	73.8	95.4	88.2	89.5	59.7	78.9	85	0
Rhodes grass	36.2	50.9	48.1	14.7	10.5	11.9	5.3	58.3	25
Rye grass	4.5	0	0	0	0	28.4	0	0	0
Giant setaria	1.4	1.6	0.8	0	0	5.9	0	0	0
Columbus grass	1.2	1.6	0	0	0	5.9	0	0	0
Herbaceous legumes									
Lucerne	8.3	13.1	3.1	0	0	11.9	0	8.3	31.3
Purple vetch	2.4	0	0	0	5.3	11.9	0	1.7	0
Lablab	1.2	0	0	0	0	2.9	5.3	3.3	0
Desmodium	5.2	6.6	0.8	0	0	1.5	0	16.7	18.8
Lupine	1.2	0	0	0	5.3	5.9	0	0	0
Fodder shrubs and trees									
Fodder shrubs	14.7	11.5	10.7	26.5	0	8.9	10.5	28.3	21.9
Tree Lucerne	2.8	1.6	3.1	0	5.3	2.9	0	3.3	6.3
Other fodder crops									
Sweet potato vines	19.2	24.6	11.5	2.9	0	2.9	10.5	55	40.6
Oats	15.6	1.6	0	0	84.2	68.7	5.3	3.3	0
Sorghum	9.7	1.6	4.6	0	5.3	14.9	5.3	31.7	9.4
Edible cana	1.2	1.6	0.8	0	0	1.5	0	0	6.3
Conserved feeds									
Conservation of crop residues	56.0	49.2	70.2	41.2	26.3	41.8	84.2	46.7	75
Silage	14.7	21.3	19.1	5.9	5.3	17.9	26.3	3.3	6.3
Hay baling	13.5	22.9	6.1	0	5.3	17.9	21.1	15	28.1
Other feeds									
Mineral supplementation	100	100	100	100	100	100	100	100	100
Concentrates	55.6	40.9	67.2	55.9	52.6	41.8	63.2	60	53.1
Feed formulation	15.8	22.9	20.6	2.9	21.1	13.4	15.8	6.7	15.6

3.8 Preference for livestock feed technologies practised

Ranking of preferred livestock feed technologies was done using the method explained in section 2. Out of all the feed technologies practised by farmers, Napier grass, kikuyu grass and conservation of crop residues were the three most preferred feed technologies in that order (Table 36). This was true for both male and female farmers.

Feed technology preference differed across sites with farmers in Cherang'ani, Kapcheno, Metkei, Olkalou and Kieni preferring Napier grass to other feed technologies while those in Tanykina and Sot preferred kikuyu grass (Table 37). Taragoon farmers preferred conservation of crop residues.

Table 36: Ranking of farmers' preference for livestock feed technologies practised by gender

Feed technology	Male (N=233) Total frequency (Total score)	Average score	Rank	Female (N=190) Total frequency (Total score)	Average score	Rank	Total (N=423) Total frequency (Total score)	Average score	Rank
Grasses									
Napier grass	(156)382	2.45	1	(135)325	2.41	1	(291)707	2.43	1
kikuyu grass	(95)221	2.34	2	(80)191	2.39	2	(175)412	2.35	2
Rhodes grass	(58)110	1.90	5	(36)63	1.75	6	(94)173	1.84	6
Rye grass	(6)15	2.5	12	(9)17	1.89	11	(15)32	2.13	12
Giant setaria	(1)3	3	18	(1)3	3	14	(2)6	3	17
Columbus grass	(2)3	1.5	18	(2)2	1	17	(4)5	1.25	18
Herbaceous legumes									
Lucerne	(10)14	1.4	13	(1)3	3	14	(11)17	1.55	14
Desmodium	(7)9	1.29	15	(0)0	0	19	(7)9	1.28	15
Purple vetch	(3)5	1.67	16	(0)0	0	19	(3)5	1.67	18
Lablab	(2)3	1.5	18	(1)1	1	18	(3)4	1.33	20
Lupine	(1)1	1	21	(0)0	0	19	(1)1	1	21
Fodder shrubs and trees									
Fodder shrubs	(14)27	1.93	10	(11)21	1.91	10	(25)48	1.92	10
Tree Lucerne	(1)1	1	21	(0)0	0	19	(1)1	1	21
Other fodder crops									
Oats	(36)79	2.19	7	(20)40	2	7	(56)119	2.13	7
Sweet potato vines	(8)13	1.63	14	(8)11	1.38	13	(16)24	1.5	13
Sorghum	(3)4	1.33	17	(2)3	1.5	14	(5)7	1.4	16
Edible cana	(1)1	1	21	(0)0	0	19	(1)1	1	21
Conserved feeds									
Conservation of crop residues	(84)174	2.07	3	(69)146	2.12	3	(153)320	2.09	3
Silage making	(27)36	1.33	8	(10)22	2.2	9	(37)58	1.57	9
Hay baling	(18)21	1.17	11	(8)16	2	12	(26)37	1.42	11
Other feeds									
Concentrates	(74)117	1.58	4	(64)109	1.7	4	(138)226	1.64	4
Mineral supplementation	(75)99	1.32	6	(78)109	1.4	4	(153)208	1.36	5
Feed formulation	(14)30	2.14	9	(18)36	2	8	(32)66	2.06	8

Total score is the sum of scores for each preference. Scores were got by multiplying frequencies on each preference level by scores assigned where low preference was given a score of 1, medium a score of 2 and high a score of 3

Table 37: Ranking of farmers' preferred livestock feed technologies practised by site

Feed technology	Cherang'ani (N=61)	Tanykina (N=131)	Kapcheno (N=34)	Metkei (N=19)	Olkalou (N=67)	Taragoon (N=19)	Sot (N=60)	Kieni (N=32)
Grasses				(Farmers' total scores)				
Napier grass	142 ¹	140 ²	84 ¹	33 ¹	98 ¹	17 ³	117 ²	76 ¹
Rhodes grass	26	65	8	2	13	0	32	27 ³
Columbus grass	1	0	0	0	4	0	0	0
Rye grass	1	0	0	0	31	0	0	0
kikuyu grass	57 ²	207 ¹	1	14 ³	0	8	125 ¹	0
Herbaceous legumes								
Lucerne	3	5	0	0	2	0	0	7
Desmodium	3	0	0	0	0	0	2	4
Lablab	0	0	0	0	8	2	0	0
Lupine	0	0	0	1	0	0	0	0
Purple vetch	0	0	0	1	4	0	0	0
Fodder shrubs and trees								
Fodder shrubs	1	9	20	0	5	3	8	2
Tree Lucerne	0	0	0	0	1	0	0	0
Other fodder crops								
Sorghum	0	0	0	4	5	0	2	0
Oats	0	0	0	30 ²	89 ²	0	0	0
Edible cana	0	0	0	0	1	0	0	0
Sweet potato vines	4	4	3	0	0	0	10	3
Conserved feeds								
Silage making	2	23	2	2	17	10	0	2
Hay baling	3	10	0	2	15	2	0	5
Conservation of crop residues	52 ³	132 ³	21	5	33 ³	27 ¹	14	36 ²
Other feeds								
Feed formulation	11	19	3	10	13	3	0	7
Concentrates	25	96	35 ²	10	22	23 ²	8	7
Mineral supplementation	34	67	23 ³	1	16	10	42 ³	15

Numerical superscripts represent the rankings

After training, it is expected that farmers will practise and/or disseminate information on the trained technologies. Results in Table 38 compare the percentages of farmers trained versus those practising technologies on farm and sharing information with fellow farmers. Of course, it is possible that farmers practising a technology or sharing it were never trained in it but nevertheless, examining the proportions in each category shows important trends. Indeed Napier grass was the only technology on which over 75% of farmers had been trained, and over 75% were practising and sharing it with others. Over 40% of farmers have been trained in six other practices, but proportions of farmers practising and sharing information about these varies. Two long-practised technologies, mineral supplementation and conservation of crop residues, had practice rates higher than training rates. One practice, Rhodes grass, had two-thirds of training rates, indicating some constraints to adoption and three had practice rates of 24-34% of training rates, indicating important constraints to adoption. These three practices were hay baling, fodder shrubs, and silage making, each of which is knowledge intensive, requiring the learning of new skills and purchase of materials. Farmers implementing practices tended to share information about them with others. Of the eight practices used by over 15% of farmers, six were shared by over 80% of those practising. The other two, mineral supplementation and concentrates, were shared by 39% and 49% of farmers, respectively.

Table 38: Percentage of farmers trained, practising and sharing information on selected feed technologies

Feed technology	% trained (N=376)	% practising (N=423)	% sharing (N=305)
Grasses			
Napier grass	77.1	81.3	75.4
Rhodes grass	57.9	37.4	37
Herbaceous legumes			
Lucerne	32.2	8	10.8
Desmodium	20.6	5.2	6.6
Conserved feeds			
Silage making	61.2	14.7	18.7
Conservation of crop residues	53	54.4	46.9
Hay baling	40	13.7	11.1
Fodder shrubs	45.9	14.7	16.4
Other fodder crops			
Sweet potato vines	29.8	19.1	22.3
Sorghum	24.6	9.7	5.6
Oats	15.8	15.6	7.5
Other feeds			
Mineral supplementation	56	100	39.3
Concentrates	50.1	55.3	27.2
Feed formulation	37.1	15.6	16.1

3.9 Test on level of understanding of livestock feed technologies

Farmers were asked questions to gauge their understanding on certain livestock feed technologies that they have been trained on. A correct score for each test was awarded 2 points, 1 for half correct and 0 for incorrect. The overall mean score of level of understanding on livestock feed technologies was 1.54 (Table 39). Both men and women had equal understanding of the technology with a mean score of about 1.5. Over 80% of farmers got responded to the questions on Napier grass correctly. They earned high scores in the three questions which included aspects on Napier grass establishment (1.86), planting of Napier canes (1.86) and planting of Napier root splits (1.78). Thus, Napier grass was the most understood livestock feed technology by farmers. Farmers also scored highly (>1.7) on questions related to sowing Rhodes grass, types of silage and use of maize as fodder. More than 75% of farmers scored correctly on questions targeting the mentioned technologies. Questions with the lowest scores included those on fodder shrubs, particularly the number of calliandra trees required per cow per year and the number of fodder trees required to be left for seed production (0.96) where only about 30% of the farmers managed to get a correct answer on each aspect.

Table 39: Farmers' mean score on understanding of livestock feed technologies

Test question	N	Mean score	% Not correct	% Partially correct	% Correct
Napier grass establishment	35	1.86 (0.38)	1.1	11.8	87
Planting of Napier canes	34	1.86 (0.37)	0.9	11.9	87.3
Planting of Napier root splits	33	1.78 (0.58)	3.3	15.1	81.6
Best time to sow Rhodes grass	17	1.76 (0.47)	1.7	20.7	77.9
Types of silage	23	1.75 (0.46)	1.3	22.8	76
Best time for harvesting maize fodder for silage	20	1.74 (0.49)	2.4	21.3	76.3
Material is needed for making tube silage	7	1.69 (0.55)	4.4	22.7	72.9
Knowledge on any shrub used for fodder	18	1.67 (0.59)	6.5	19.9	73.7
Best stage to cut Napier for silage	31	1.59 (0.63)	7.4	26.6	66
Which is the best stage to cut Rhodes grass for making hay	15	1.58 (0.62)	7.1	27.9	64.9
Is Nandi setaria an annual or perennial grass	4	1.49 (0.68)	9.8	31.7	58.5
Suitable niches for growing shrubs	12	1.41 (0.75)	16.1	26.6	57.3
Best season for sowing Rhodes grass	4	1.33 (0.74)	16.3	34.7	49
Pretreatment of Calliandra seeds	98	1.30 (0.82)	22.4	25.2	52.3
Growing mulberry with other food crops	10	1.24 (0.70)	17.6	41.1	41.1
Recommended spacing for Calliandra	34	1.14 (0.83)	28.4	29.4	42.2
Required number of Calliandra trees per cow per year	2	0.96 (0.83)	36	32	32
Required number of fodder trees for seed production	10	0.96 (0.80)	33.3	37.3	29.4
Number of 70kg freshly cut Rhodes grass needed per cow per day	2	0.9 (0.76)	34.2	41.4	24.4
Overall		1.54 (0.3)			

Figures in parenthesis are standard deviations

4.0 DISCUSSION

The study found that radio was the most accessed source of information on livestock feed technologies by the sampled farmers. Indeed, literature has it that a good proportion of Kenyan households have access to radios (Mzungu, 2013). The authors noted that 9 out of every 10 adults listen to radio on a weekly basis. In some of the discussions with the farmers it was reported that local radio stations such as Inooro FM, Chamgei FM and Kass FM air agricultural programmes in the local language thus making them a favorite learning media for rural farmers. Similar to these findings, Oladeji *et al.* (2011) noted that radio was a major source of information for farmers in Nigeria. In contrast, Boateng *et al.* (2014) indicated low use of radio in Ghana with farmers citing that the information passed through radio was too general and therefore not useful to their specific conditions.

The CESP and neighbours were the second and third most accessed sources of information. The two sources were found ideal probably because of their proximity to farmers. Farmers prefer learning from their neighbours where they can copy successful technologies. Additionally, neighbours have a good understanding of the locals and are therefore better positioned to address farmers' specific needs. With regard to gender, a comparatively higher percentage of male farmers had access to a number of information sources. Examples include radio, field days, agricultural shows, skilled farmers, written materials, demonstrations, newspapers, breeders' shows, mobile phones and posters. Clearly, male farmers have more access to both electronic and interpersonal sources of information than their female counterparts. This can be explained by the fact that male farmers are more literate and therefore are more informed on available information sources. In addition, since they have fewer commitments at home than do women, they can access information sources away from the farm more readily than the women.

Relative to other sources, the VFTs were ranked 6th overall and were accessed by 26.7% of farmers. Given that only about one-fifth of the DMGs had volunteer farmer trainers, the data shows that VFTs were important sources of information where they were available and in a limited number of other DMGs as well. The VFTs have an added advantage because they use the local language, live in the same local conditions and share the same resources with the farmers, meaning that they are able to understand farmers' needs better than other people. Additionally, the VFTs are trained and known to the farmers and are therefore, to some extent, able to win farmers' trust as reliable information providers.

Disaggregating by household type, results in Table 11 show that a higher proportion of women in male-headed households had access to the MoALFD and private service providers than women-headed households. The VFTs, on the other hand, were the fifth most accessed information source by women-headed households and were ranked 8th by women in male-headed households. This shows that the VFTs were among the most frequently accessed information sources by women-headed household, perhaps because of their proximity implying that less cost is needed to access them. The ranking of VFTs varied across sites. Implications are that some farmers do not appreciate the VFTs which could be because they feel that fellow farmers might not have enough skills and knowledge to educate them

compared to other professional extension agents like government extension staff. There was no correlation between the ratio of farmers per VFT and percentage of farmers accessing information from VFTs per site.

Further analysis on access to information sources was done by site. Results show that radio was mostly accessed by farmers in Tanykina, Kapcheno, Metkei, Olkalou and Taragoon, while Kieni farmers had more access to MoALFD. Radio is thus a vital source of information on new technologies for rural farmers. Generally, VFTs were mostly accessed in Kieni, Sot and Kapcheno sites. The VFTs in these sites were probably active in disseminating information. Except in two DFBAs, findings revealed that the ratio of VFTs to farmers in a site influenced the percentage of farmers accessing information from them. Areas with higher percentage of VFTs recorded higher percentages of farmers accessing information from the trainers.

More than 80% of the farmers accessed information on Napier grass, mineral supplementation and concentrates, depicting that a majority of farmers tend to access information on common feeds. Differentiating by gender, male farmers had more access to information on lucern, desmodium silage making and fodder shrubs compared to female farmers. Male farmers have more access to information on modern technologies than female farmers. This is tied to the fact that a higher percentage of male farmers have access to more information sources (10) than female farmers, thus making them more aware and interested in new technologies. Likewise, an analysis by women household types shows that a higher percentage of women in male-headed households had access to information on Rhodes grass, conservation of crop residues and feed formulation compared to their counterparts in women-headed households.

With regard to the source of livestock feed information, the study found that farmers' access information on different livestock feed technologies from particular sources. Most farmers received information on mineral supplementation and concentrates from the radio. Radio therefore played a major role in informing farmers on the use of common feeds. Radio is also mostly used to pass information on general knowledge as opposed to specific knowledge. Information on Napier grass, Rhodes grass, conservation of crop residues, silage making and fodder shrubs was accessed through the CESP, field days and MoALFD. Hence, technologies that required demonstrations were mostly accessed from interpersonal sources (or face to face sources). Such sources provide specific information and are critical in informing farmers on modern technologies.

Further, results show the important technologies disseminated through each source. Radio covered concentrates, mineral supplementation and Napier grass as key technologies. Additionally, Napier grass and silage making were the most important technologies for MoALFD, CESP and field days. Volunteer farmer trainers, on the other hand, covered Napier grass, Rhodes grass, conservation of crop residues and mineral supplementation as their key technologies. Notably, radio is an importance source of information on traditional

practices while MoALFD, CESP and VFTs are important information sources of both traditional and modern technologies.

Photo1: A Napier grass demonstration plot in a VFT's plot

The three most preferred sources of information were listed as CESP, radio and MoALFD. The use of CESP reflects the role of community extension officers in providing information to farmers. Being professionals in extension gives the CESP an upper hand. Radio was ranked second perhaps because it is available in rural areas. It was noted during the survey that CESP work closely with the MoALFD which explains why the ministry was the third preferred source of information by farmers. These results echo the findings of Ogunremi *et al.* (2013) who reported that aquaculture farmers in Nigeria preferred radio and extension agent sources.

The VFTs were the sixth preferred source overall. While some sites appreciated the work of VFTs, farmers in Metkei, Taragoon and Tanykina gave a low score to the trainers. These sites had challenges in maintaining their groups and hence VFTs may not have had forums for sharing information. Some farmers did not value information received from fellow farmers and preferred getting information from other experts in agriculture. In addition, there were instances when VFTs were not performing to their potential.

Interestingly, exchange visits and skilled farmers were among sources with low preference. The farmers visited were perhaps at too high a level to provide knowledge and advice that was useful to other farmers. Feder and Savastano (2006) confirm this finding in their study on the role of opinion leaders in diffusing new knowledge among farmers. In this case, farmers learnt best from people just above their level, and not too high.

While both genders had a strong preference for CESP, the study shows that female farmers had a higher preference for neighbours as sources of information while males preferred MoALFD staff. Female farmers therefore prefer using their social networks to acquire information. The findings coincide with those of Conley and Udry's (2010) on their estimate of the effect of observing neighbours.

Reliability, frequency of contact, accessibility and affordability of the three most preferred sources were analysed in this study. Further, similar aspects were used to rate how the VFTs fared compared to the three preferred sources. Overall, farmers ranked CESP, MoALFD and VFTs as more reliable sources than radio. This finding probably reflects farmers' preference for learning by seeing and direct interaction rather than just hearing. Further, results on frequency of use indicate that farmers had more contact with CESP and VFTs as compared to radio and MoALFD. Additionally, CESP, radio and VFTs were viewed as more accessible and affordable than MoALFD. The issue of distance to the source of information seems to play a paramount role in enhancing access to information. Unlike CESP and trained farmers, the government extension staffs operate from their offices which may be far from farmers' homes. Overall, CESP and VFTs had the highest scores on reliability, frequency, accessibility and affordability and were therefore very effective sources of information dissemination. Differentiating by gender, male farmers appeared to favour CESP while female farmers found neighbours to be more effective. Earlier results support the finding where male farmers were found to have better access to community extension staff than female farmers who as a result sought information from their neighbours.

With regard to training received, the proportion of men and women DFBA members trained in feed technologies was about the same, 90.1% for male members and 87.4% for women. However, it would appear that women received training on fewer technologies than men. The results further indicate that women in female-headed households received much less training than did women in male-headed households. Disaggregating by sites, Napier grass was the most trained technology in all sites. This could be because the grass is adaptable in all agro ecological zones and is a common feed to all farmers. The findings show that institutions still offer trainings on conventional feeds, such as concentrates and mineral supplementation. Such trainings are important for updating farmers' skills. Regarding the training institution, the study reported that farmers receive trainings from a number of institutions namely CESP, neighbours, MoAFLD, input dealers, self-experience, VFTs, NGO, FTC, KARI and ASK. Generally, all institutions except input dealers offered training on Napier grass particularly on new varieties. Input dealers trained on feeds that they supplied which included mineral supplements, concentrates and Rhodes grass.

After training, farmers take pride in sharing information with their neighbours, either individually or in groups. In this study it was found that more than 70% of farmers shared information obtained from trainings with other farmers. As noted by Kiptot and Franzel, (2013b) the main motivation for sharing information with others is social capital gains such as personal satisfaction, recognition, gaining confidence, increased social networks, and enhanced social status through fame and popularity. Majority of the farmers shared knowledge on Napier grass, conservation of crop residues, Rhodes grass, mineral supplementation and concentrates. However, 77% of males shared information while only 66% of women did so, though the difference was not significant. Males and females also shared the same numbers of practices, about 3.5, with others.

With regard to the practices on farm, more farmers practised Napier grass, mineral supplementation and concentrates compared to other feed technologies. This shows that farmers still use traditional feed practices. The high usage could also be linked to the availability of the feeds and that farmers have knowledge and skills on these particular feeds. There were few differences between gender groups where more women in male-headed households practised conservation of crop residues than women in female-headed households. Married women have greater access to livestock feed resources than single women.

Discerning by sites, the use of kikuyu grass was common among farmers in the Rift Valley region (Cherang'ani, Tanykina, Kapcheno, Metkei, Taragoon and Sot). Farmers in the central region of Kenya (Kieni) preferred Napier grass and conservation of crop residues. It is evident that farmers with large farm sizes, such as those in Rift Valley, are reluctant to adopt conserved feed as compared to those with small farm sizes.

Photo 2: Cows feeding on kikuyu grass under paddocking system in Cherang'ani

Generally, there was limited use of fodder shrubs and herbaceous legumes (lucerne and desmodium) across the sites. Farmers attributed this to lack of seedlings and planting material, as well as information. During our field work for instance, we spotted desmodium in the farms, along river banks and at the roadside but surprisingly farmers were not aware of the plant. One farmer said *“When I cut grass for my cow, I realized the cow eats even this weed (desmodium) but I did not know that it is a very important livestock feed. I will start growing it on my farm”*. Training institutions definitely need to identify such gaps and offer required training.

Photo 3: A farmer picks desmodium vines to plant in his farm

Analysis of preferred livestock feed technologies showed Napier grass as the most preferred feed technology. Kikuyu grass came second, meaning that farmers value natural grass perhaps because it's readily available and comes at no cost. The third preferred technology was conservation of crop residues, implying that farmers are embracing conservation techniques that can boost milk production in dry seasons. There was no gender difference in the preference of technologies practised. However, practices differed across sites. Farmers in Tanykina and Sot preferred kikuyu grass, those in Cherang'ani, Kapcheno, Metkei, Olkalou and Kieni preferred Napier grass, while those in Taragoon preferred conservation of crop residues.

A comparison between technologies trained with those practised and/or shared shows a worrying trend on the adoption of modern feeds. Diffusion of information and adoption of common feeds like Napier grass was high. However, farmers face challenges in adopting other feeds namely Rhodes grass, silage making, hay baling and fodder shrubs among others. This could be due to the cost involved in preparing the feed, and characteristics of the technology, e.g. long wait before harvesting. Other factors such as labour and land requirements might also have contributed to low adoption. Access to planting materials and other resources for making the feeds could also be an issue. *"Madam, do you have calliandra seeds? Where can we get them?"* This question came up in most interviews. It shows that farmers have inadequate information on where to obtain seeds.

Results on the farmers' level of understanding of livestock feed technologies reveal that farmers have a good grasp of the livestock feeds. The mean score was similar for men and women. Overall, majority of the farmers had better understanding of Napier grass as compared to other feed technologies. This was expected since Napier grass is a common technology that cuts across all sites. Additionally, farmers were found to have accessed more information on Napier grass and were also trained on the same. Silage making was another well understood technology. The study shows that even though there is low usage of silage, farmers have good knowledge on it. The fact that farmers do not use a particular technology does not necessarily mean that they do not understand it.

5.0 CONCLUSION AND RECOMMENDATIONS

This study set out to determine farmers' sources of information, preference and determinants of accessing preferred information sources. It further documents the extent of information sharing by farmers. The findings provide important insights into how information is disseminated among smallholder farmers. It is evident that radio is the single most accessed source of information followed by CESP and MoALFD, in that order. There is a significant difference in access to information sources between male and female farmers; a higher percentage of male farmers have access to both electronic and interpersonal sources. Future studies should provide insights on the causes of the differences and suggest solutions that would promote equity in access to information between genders.

With regard to the preferred information sources, the study identified CESP, radio and MoALFD as the first, second and third most popular sources, respectively. Clearly, both impersonal and interpersonal information sources are preferred by farmers in the study area. Volunteer farmer trainers were ranked sixth and scored highly on reliability, frequency of contact, accessibility and affordability. Their role in information dissemination is thus important, especially relative to their cost, which is much lower than other information sources. There is need for agricultural organizations, both government and NGOs, to sensitize farmers on the importance of groups and train more farmers.

Generally, farmers access information on farm practices that are common in their area. In this study Napier grass appeared as the most common practice across sites. Regardless of the source, findings revealed that information on familiar technologies such as Napier grass was the most accessed. Yet, farmers reported to have adequate knowledge of the technologies. The reasons may be because rates of use are still quite low for some (e.g. concentrates) and management of others (e.g. Napier grass) can be improved to increase yields.

The study highlighted the relationship between the type of technology accessed and the source of information. Evidence shows that impersonal sources are useful in accessing information on common and less technical technologies, while the interpersonal sources are useful for newer and more complex technologies. Thus, for successful information dissemination, agricultural extension service providers need to make appropriate choices on the dissemination media based on the technology to be trained.

Viewed from the gender lens, evidence suggests that male farmers and women in male-headed households have more access to information than female-headed households. This could be attributed to limited education, mobility and productive resources of the female heads of households. Further, findings on information sharing show that men are more active in information sharing than women. The results put across gender disparities in access to information that need to be addressed. Extension agents need to make deliberate efforts to reach farmers in female-headed households. Additionally, policy makers may be required to come up with policies to enhance information dissemination, taking in consideration the differences between genders.

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United Nations Avenue, Gigiri • PO Box 30677 • Nairobi, 00100 • Kenya

Telephone: +254 20 7224000 or via USA +1 650 833 6645

Fax: +254 20 7224001 or via USA +1 650 833 6646

Email: worldagroforestry@cgiar.org • www.worldagroforestry.org