EFFECTIVENESS OF THE LEAD FARMER APPROACH
IN THE DISSEMINATION OF SOIL FERTILITY
MANAGEMENT TECHNOLOGIES

Submitted By

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ABSTRACT

This study evaluates the effectiveness of the Lead Farmer Approach (LFA) as a soil fertility management and information dissemination approach. Quantitative and qualitative research methodologies were used to generate data. Quantitative data was generated using structured questionnaires. On the other hand qualitative data was generated through interviews with key informants with and group discussions with follower farmers. These methods were used to assess the effectiveness of Lead Farmers as trainers of follower farmers and the increase in knowledge of the follower farmers. In addition, the study examines the socio-economic characteristics of Lead Farmers. Results from the study show that the LFA is an effective way of disseminating soil fertility management technologies. This was indicated by the increased level of knowledge of the follower farmers after they were trained by the lead farmers. Land size, general performance of the lead farmers and meetings were the factors that significantly affect the effectiveness of the lead farmer approach as a soil fertility dissemination approach. Results from the study lead to the recommendation that LFA should be scaled up and that various donors and relevant government departments ought to provide the necessary financial and logistical support to train more Lead Farmers.
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DEDICATION

To my twins Prosper and Pagiel, together with my first born, Purpose; thank you very much for your patience while I was busy with my studies.
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ABBREVIATIONS AND ACRONYMS

AEO  Agricultural Extension Officer
AEW  Agricultural Extension Supervisor
AGRITEX Agricultural Technical and Extension Services
AN   Ammonium Nitrate
BMGF Bill and Melinda Gates Foundation
BNF  Biological Nitrogen Fixation
CADS Cluster Agricultural Development Services
CBEAS Community Based Extension Approaches
CIAT International Centre for Tropical Agriculture
CONEX Department of Conservation and Extension
DEVAG Department of Agricultural Development
F-t-F Farmer-to-Farmer
FE   Forced Extension
FFS  Farmer Field School
IITA International Institute for Tropical Agriculture
IPPM Integrated Production and Pest Management
LFA  Lead Farmer Approach
MF   Master Farmer
N    Nitrogen
N2Africa Putting Nitrogen to Work for Smallholder Farmers in Africa
NGO  Non-Governmental Organisation
SMS  Subject Matter Specialist
SSA  Sub-Saharan Africa
T&V  Training and Visit
ToT  Transfer of Technology
WUR  Wageningen University and Research Centre
CHAPTER ONE

1. INTRODUCTION

1.1 Introduction

Soil fertility decline is one of the major problems affecting agricultural production in sub-Saharan Africa (SSA), where most of the people derive their livelihoods from (Sanchez et al., 1997; Odendo et al., 2010). Soil degradation is a serious problem in Zimbabwe where livelihoods of most people in rural areas depend on agriculture. Farmers continue to deplete soil nutrients in order to produce food and earn cash. Nitrogen is regarded as the most limiting nutrient in Zimbabwe (Mapfumo and Mutambanengwe, 1999). According to Prasad and Power (1997), maintenance and management of soil fertility is key to the development of food production systems. The extension of soil fertility technologies has been conducted using different agricultural extension models and farmers have adopted these technologies at different, leading to fast or slow adoption of these agricultural technologies.

Agricultural extension services have been scaled down in most developing countries, especially in Africa (Degrande et al., 2012). The agricultural extension, being one of the main institutional components of agriculture, needs to be developed into low-cost suitable technologies that will provide services beyond message extension. Farmers should play a pivotal role and become principal change agents in their communities (Lukuyu, et al., 2012). The adoption of the agricultural technologies largely depends upon the effectiveness of the methodologies being employed (Marume, 2010). The role of
agricultural extension includes dissemination of agricultural technologies, capacity building of farmers through a variety of training approaches so that farmers can make right decisions. Resultantly, complex agricultural demands are met, poverty is reduced and soil fertility is enhanced together with better natural resources management (AL-Sharafat et al., 2012; Degrande et al., 2012).

The effectiveness of the agricultural information dissemination will ensure that food security, soil fertility management, and sustainable ecological resources are preserved and enhanced by smallholder communities (Marume, 2010; Degrande et al., 2012; Lodhi, et al., 2012). Sustainable use of natural resources, poverty reduction, balance of social inequalities and participatory development are some of the objectives crafted in the United Nations Millennium Project, and agricultural extension can immensely contribute to these (Degrande, et al., 2012; Marume, 2010). Agricultural extension provides a meaningful framework through which farmers are organised into institutions in order to gain access to production resources such as capacity building, loan facilities, inputs, marketing services and other development programs (Lodhi, et al., 2006).

With the increasing pressure for land and other resources, the need for training farmers in new soil fertility technologies is strongly increasing.

1.2 Soil fertility Status in Zimbabwe

About 65% of the population in Zimbabwe lives in rural areas and depends on agricultural activities for their livelihoods (CSO, 2004). A large percentage of arable land in the communal areas of the country is covered by inherently poor soils (Mtambanegwe and Mapfumo, 2009). The poor soil fertility in most of these communal areas in Zimbabwe is a major constraint to sustainable crop production (Nyamangara, et al., 2000). Farmers
continue growing maize on these poor sandy soils and this depletes the main limiting soil nutrient that is essential for crop growth; nitrogen. Farmers can improve soil fertility by use of mineral fertilizers, compost manure, farmyard manure and recycling of crop and organic residues. However, many farmers cannot afford to purchase mineral fertilizers because they are costly and there are insufficient quantities of manure among the smallholder communities to effect an improvement in crop productivity and soil fertility. Although agricultural food production is seriously limited by poor and unproductive soils (Mtambanengwe and Mapfumo, 2009), there has been poor adoption of soil fertility technologies by farmers in the region.

1.3 Soil Fertility Improvement Using Legumes

Legumes have been promoted among smallholder farmers in Africa because of their nitrogen fixing capacity, potential income generation and their contribution to food and nutrition security. Legumes have the ability to fix atmospheric nitrogen and are usually grown on a small scale in Zimbabwe, mostly as an intercrop with maize (Bationo, 2011). The most important legume crops being grown in Zimbabwe are groundnuts (*Arachis hypogaea*), cowpeas (*Vigna unguiculata* (L) Walp), soya bean (*Glycine max* L Merril) and sugar bean (*Phaseolus vulgaris* L). The promotion of legumes in sub-Saharan Africa offers important opportunities for the improvement of smallholder livelihoods, sustainable land management and soil fertility management. The efficient nitrogen fixation capacity of the legumes offers a great opportunity for soil fertility enhancement among smallholder farmers.
1.4 A Historical Overview of Extension Approaches

Several agricultural extension approaches have been developed for the dissemination of soil fertility technologies, starting from the linear top-down model which was Transfer of Technology (ToT) approach (Birnar et al., 2006; Hanyani-Mlambo, 2009). In Zimbabwe, agricultural extension was introduced by Desmond Emery Alvord after he observed that the maize crop which was being grown was failing to produce substantial yields and the soil was in a poor state. As Chibudu, et al., (2001) assert, soil management issues in the Communal Areas of Zimbabwe started during the colonial era when soil erosion and soil fertility loss were discovered as the main causes of poor crop production. Further studies by Elwell (1974) suggested that soil fertility was poor and it was getting worse.

The first extension approaches in Zimbabwe were developed mainly to disseminate information on land degradation and soil infertility. The Training and Visit (T&V) system which was developed by Daniel Bernor for the World Bank (Bernor and Harrison, 1977) was introduced as the model of extension for most governments in developing countries. However, resulting from limited fiscal resources, the system could not work effectively due to limited farmer participation (Hanyani-Mlambo, 2002). In addition, farmers were treated as merely passive recipients of technologies and because of this there was low adoption of agricultural technologies (Bonye et al., 2012).

The inappropriateness of the top-down extension approaches has given rise to community based extension approaches (CBEAs) where farmers form part and parcel of the extension services delivery system. Knowledge transfer from one farmer to another farmer occurs through various means. CBEA have gained increasing significance in agricultural technology dissemination. The CBEA is a concept aimed at addressing inadequacy and ineffectiveness of the formal extension services to rural farmers. The CBEA builds on the
mechanisms for extension acquisition at community level and it evolves around persons who are in the community (Bonye et al., 2012).

Several CBEAs have been implemented and these include farmer-to-farmer (FtF) extension approaches, Farmer Field Schools (FFS), Commodity Groups, and recently, the Lead Farmer approach (LFA) (Bonye et al., 2012; Nhongonhema, 2010; Hanyani-Mlambo, 2002; Davis, 2008). Studies have been done to evaluate the effectiveness of some CBEAs in technology dissemination, however, the LFA is a relatively new approach and little has been done to assess its effectiveness as a technology dissemination tool. The aim of this study will be to evaluate the LFA as it has been implemented by the project ‘Putting nitrogen Fixation to Work for Smallholder Farmers in Africa’, better known as N2Africa, in Zimbabwe.

1.5 The Lead Farmer Model of Technology Dissemination

The Lead Farmer model of technology dissemination where lead farmers are trained and then pass on the knowledge on new technologies to their peers seems popular with donor organisations. This technology dissemination approach was adopted by the N2Africa project.

N2Africa is a research and development project that disseminates and promotes appropriate Biological Nitrogen Fixation (BNF) technologies to smallholder farmers. The project links the protein needs of smallholder African farmers directly to atmospheric nitrogen reserves by providing them with income generating projects. The project aims to achieve this objective by integrating new BNF technologies into smallholder farming systems. Farmers are trained and assisted in increasing production of common beans, groundnuts, cowpeas and soya beans. These four crops are known for their high nitrogen
fixation capacity and in the long term the project helps farmers to practice renewable soil fertility management and profitable new technologies and value-adding enterprises.

The N2Africa project is funded by the Bill and Melinda Gates Foundation through a grant to Plant Production Systems, Wageningen University (WUR) in the Netherlands. The project is led by WUR together with International Centre for Tropical Agriculture (CIAT) and International Institute for Tropical Agriculture (IITA). The project is being implemented in eight countries in Africa (DRC, Ghana, Kenya, Malawi, Mozambique, Nigeria, Rwanda and Zimbabwe). In Zimbabwe, the project is being implemented in seven districts; Chegutu, Goromonzi, Guruve, Hwedza, Makoni, Mudzi and Murehwa. Within three year of its implementation, the project is targeting 30 000 households. The project has adopted the lead farmer approach to disseminate agricultural technologies. In the N2Africa project, the lead farmer works with groups of 15 to 30 follower farmers around him or her. The lead farmer is the main contact for the project and partner organisations. The lead farmers receive training from agricultural extension services and partner organisations and then they go and train their follower farmers. The purpose of this study is to evaluate the effectiveness of the lead farmer approach as it has been implemented N2Africa project in Zimbabwe.

1.6 Statement of the Problem

There is increased demand for extension services in both the communal areas and new resettlement areas in Zimbabwe. The government extension can no longer cope with the demand for the services, while the non-government organisations (NGOs) cannot financially sustain the demand for extension delivery. A number of approaches have been designed to redress the situation, and the LFA is one such approach. The Lead Farmer
approach is being promoted by the donor communities and needs to be examined as to whether it is effective in the dissemination of soil fertility technologies.

1.7 Aim

This study explores the effectiveness of using the lead farmer approach in technology dissemination within the N2Africa project in Goromonzi District in Zimbabwe, focusing on soil fertility, land management and legume technologies.

1.8 Research Objectives

1. Evaluate follower farmers’ views on how the Lead Farmers have trained the different soil fertility technologies being promoted by the N2Africa project.

2. Examine whether the lead farmer approach has a positive influence on knowledge of soil fertility management of follower farmers.

3. Determine the socio-economic factors that can contribute to an increase in knowledge of soil fertility management among follower farmers using the lead farmer approach.

1.9 Research Questions

1. How do follower farmers rate their Lead Farmer in terms of leadership, effectiveness, transfer of knowledge, and training?

2. Can an increase in knowledge of farmers be observed resulting from their participation in group of Lead Farmer and training?

3. What are the socio-economic factors that contribute to the effectiveness of a lead Farmer?
1.10 Justification

The main challenge faced in agricultural extension is the lack of approaches that are cost effective and at the same time effective enough to bring desired results (Lukuyu, et al., 2012). Agricultural extension, if well designed and executed appropriately, will address challenges of soil fertility, land degradation, food security, climate change and malnutrition among others.

Studies have been done to evaluate the impact and effectiveness of different agricultural extension approaches. The main reason for all these assessments is to find which agricultural extension methodologies can be effective to enable farmers to enhance the standard of living of smallholder farmers through agriculture.

The Lead Farmer approach has been developed and used in the dissemination of technologies that are being promoted by the N2Africa project. N2Africa has implemented the LF approach in order to reach a large number of farmers with extension services in short period of time, given the limited numbers of agricultural extension agents and inadequate funds.

Despite its widespread application in eight African countries, the LF extension approach has not been evaluated to check whether it is really effective in the transmission of knowledge on soil fertility management to farmers. Evaluation of this approach will lead to recommendations that will inform decision makers on how best to come up with factors that are considered for selection of Farmer-to-Farmer extension methodologies.
1.11 Research Framework

The methodology to be used in evaluating the effectiveness of the LFA is inspired by the framework for designing and analysing agricultural advisory services by Birnar et al. (2006). The framework (Figure 1) highlights the major characteristics of agricultural extension services that form the basis of decision making among policy makers. Birnar et al. (2006) point out that the framework has been designed for two main reasons which are (1) to assist in the design and reform of agricultural extension services and (2) to guide applied research on agricultural extension services.

Farming systems and socio-economic factors of farmers play a very important role in the way farmers can adopt technologies from different extension models (Fig 1). According to Birnar et al., (2006) heterogeneity in terms of land holdings and assets, education levels, and gender roles influences the capacity of farmers to cooperate in extension activities. Performance indicators of agricultural extension services refer to the quality of outputs of an extension service, which then lead to immediate outcomes – changes in farmers’ behaviour, like change in knowledge, change in agricultural practices and adoption of innovations at household level (Fig 1). The end result will then be outcome impact which contributes to the broader societal goals. The authors highlight that indicators of effectiveness are useful if they contain information from clients (follower farmers in this case) and this formed the goal of this study. From this a conceptual framework will then be designed to suit the scope of the study at hand.
Figure 1: Conceptual Framework for evaluation of agricultural technologies

Analytical Framework. Adapted from Birnar et al, 2006 (pg 26)
1.12 Study Site

The study was conducted in Goromonzi district of Zimbabwe. Goromonzi district lies in Natural Region IIA of Zimbabwe, with an annual average rainfall of 800 mm. The main livelihood activity of the district is crop production with some farmers owning cattle and goats. The district was purposively picked because of its agricultural activities and also the declining soil fertility resulting from continuous cropping. It is one of the districts where the N2Africa project is implemented using the Lead Farmer approach to reach farmers with legume technologies.

1.13 Data Collection and Analysis

This study used both qualitative and quantitative data collection approaches. The study employed three main methods of data collection: survey instrument, semi-structured interviews and key informant interviews. The researcher collected quantitative data from respondents using pre-coded questionnaires.

Qualitative data was collected through the use of semi-structured questionnaires. This was done through Focus Group Discussions which were facilitated by the researcher. Five focus groups were convened and their responses captured. The focus group discussions assisted in the collection of information that was not captured in the pre-coded questionnaires. Stakeholders who contributed to the project were also interviewed as key informants. The stakeholders included officials from AGRITEX (Department of Agricultural Technical and Extension Services) and from the NGO partner that was involved in the implementation of the project.
1.14 Data Analysis

T-tests were used to compare the mean scores in the knowledge of follower farmers before and after the trainings. Linear regression was used to estimate the factors that contributed to the increase in knowledge of the follower farmers after they were trained by the lead farmers.
CHAPTER TWO

2. LITERATURE REVIEW

2.1 Introduction

One of the challenges affecting agricultural extension is to design and come up with low-cost agricultural extension approaches that ensure service provision of sustainable technologies to farmers (Lukuyu et al., 2012). During the 1960s and 70s, governments in developed countries invested immensely in agricultural extension. Agricultural extension agents were employed as civil servants who were paid using public funds. About 80 percent of extension services in the world are publicly funded and delivered by civil servants. It becomes very expensive on the part of government fiscus to fund these extension programmes.

Feder et al. (1999) alludes to the fact that extension agents are the most widely distributed government representatives at local level and there is always a temptation to give them more government functions which are not in line with their mandate. According to Feder et al. (1999) the main challenges that face extension are lack of information and organisation that will ensure that agriculture meets complex demands, reduce poverty, address soil fertility and preserve ecological natural resources. The other challenge is that there is lack of funding for agricultural extension resulting in demotivation of agricultural extension staff in carrying out their duties. Poor performance of extension has been caused by bureaucratic inefficiency, poor program design and incoherent links with farmers and the research sector (Feder et al., 1999).
In Zimbabwe, adoption of soil management technologies by smallholder farmers has been lagging behind (Gwandu et al., 2013). This is due to the lack of access to information generated through formal research, appropriate information dissemination strategies, lack of knowledge sharing platforms and inappropriate agricultural technologies (Feder et al., 1985; Mapfumo and Mtambanengwe, 1999). This has resulted in farmers not getting access to knowledge about soil fertility technologies although they are faced with declines in crop yields due to soil degradation.

2.2 Importance of Technology Dissemination to Farmers

According to Jamilah et al., (2010) agricultural extension begins with knowledge management and ends with human enrichment. Agricultural extension promotes adoption of new technologies and innovations which result in behaviour change by farmers in the way they do their activities. This results in a change in attitude, knowledge and skills. As Sinkaiye (2005) puts it, agricultural extension involves dissemination of information and capacity building in farmers through an array of communication methods so that eventually they are able to make informed decisions. Agricultural extension promotes the transfer and exchange of information which can be converted into functional knowledge (Lodhi et al., 2006).

2.3 Historical Overview of Agricultural Extension in Zimbabwe

In Zimbabwe agricultural extension was first introduced in 1927 by Emery Desmond Alvord (Hanyani-Mlambo, 2002). Alvord introduced the extension systems after he found out that the maize crop being grown by farmers was failing to produce some substantial yields and the soil was in a poor state (Kramer, 1997). From the early stages of its
inception in Zimbabwe (then Rhodesia), agricultural extension was aimed at building up and maintaining soil fertility (Kramer, 1997). During that period, agricultural extension services provision was divided along racial lines. White farmers were getting excellent services while blacks were poorly served and were not exposed to adequate information to improve their farming practices.

Two agricultural extension divisions were formed, namely Department of Conservation and Extension (CONEX) and Department of Agricultural Development (DEVAG) (Cobbett, 1985). CONEX was established under the Department of Research and Specialist Services (DR&SS) in 1948 (Rusike et al., 2004). DR&SS had a mandate of agricultural research while DEVAG was supposed to provide extension services to smallholder farming communities. Extension given to black rural farmers emphasized more on soil and vegetation conservation especially targeting construction of contours. The extension system introduced by Alvord promoted the training of master farmers who could then be eligible for application for African purchase lands. The type of extension used was the top-down approach where farmers were treated as passive recipients of agricultural technologies. It also employed the use of agricultural demonstrations and the use of the master farmer concept (Pazvakavambwa, 1994). The agricultural extension messages during the pre-colonial era emphasized soil and water conservation, especially the construction of contours (Kramer, 1997).

2.4 Role of AGRITEX in Zimbabwe

After Zimbabwe attained its independence in 1980 the Department of AGRITEX was formed as an amalgamation of DEVAG and CONEX (Pazvakavambwa, 1990). Since then, AGRITEX has had a mandate of providing agricultural extension services to
farmers both in commercial and communal set-up, though the main mandate was to serve farmers in the communal areas. AGRITEX aims to provide general extension services and train farmers in the use of new technologies, with the aim of increasing productivity while maintaining the sustainability of the agricultural production base, that is soil fertility. AGRITEX has been disseminating technologies generated by agricultural research institutions through appropriate dissemination strategies such as demonstrations, field days, farmers’ meetings and use of media (Bonye et al., 2012). The department of AGRITEX uses an array of approaches in the dissemination of technologies to farmers. These include, among others, the Master Farmer approach, T&V approach, and CBEA (Hanyani-Mlambo, 2010).

2.5 Challenges of the Extension System by AGRITEX

Hanyani-Mlambo (2002) reported that AGRITEX faced some fairly serious problems, especially the loss of experienced staff between 1981 and 1985. This has tended to be a perennial problem that the department has been facing. The economic structural adjustment programs introduced by the government of Zimbabwe in the 1990s led to massive exodus of experienced extension agents out of the country to look for greener pastures. According to Gwarazimba (2011), agricultural experts have left the country due to a lack of motivation and lack of acknowledgement for their contribution to national agriculture.

The land reform program that was initiated in the year 2000 also catapulted the need for extension services in the newly resettled areas and this led to an increase in the extension worker to farmer ratio from 1:800 to 1:3000. The extension agents could no longer cover all their geographical areas.
2.6 Top-Down Extension Approach or Transfer of Technology Approach (ToT)

The type of extension was based the “trickle-down” theory where farmers were to receive extension information and were expected to pass the information to other farmers (Nhongonhema 2010). This model for extension was used Zimbabwe in the 1960s to late 1970s to promote construction of contours to reduce soil erosion (Hanyani-Mlambo 2002). Farmers were supposed to accept and adopt whichever type of technology that was disseminated to them. The ToT approach proved to work in some instances, for example, in the promotion of hybrid varieties (Mudimu, 1998). Research was done at agricultural research stations and institutions and the research would be passed on from researchers to agricultural extension personnel who would then train farmers on the proven new technologies.

In the ToT approach technologies were developed by scientists and were passed on to extension services to be transferred to final users (FAOUN, 1997). One weakness of the ToT model was that it did not involve farmers in identification of farmers’ problems and adaptation of the research to local conditions. The model was used in Zimbabwe in the “KohwaPakuru” program which was aimed at encouraging farmers to use herbicides and pesticides and it failed (Nhongonhema, 2010). However, success of the ToT approach was realized in the promotion of tobacco among smallholder farmers which was conducted by the Farmers Development Trust (FDT) (Nhongonhema, 2010). There was an increase in the yield of tobacco when this extension approach was used. Adoption of the recommended technologies though, was very low. From the ToT model of extension it was noted that farmers would not take up technologies which are forced on to them despite the technologies being beneficial to them.
2.7 Forced Extension (FE)

Forced Extension (FE) was used during the 1960s to late 70s with the aim of protecting natural resources through soil conservation techniques. The Rhodesian government at the time made it a policy that each and every household was to construct contours and storm drains in their fields to control soil erosion. Farmers were also forbidden from pulling sleighs along roads. Because some of the technologies were not explained well to farmers, farmers did not completely understand why they were forced to do certain things and forbidden others, and therefore they did not take up the technologies – even though the technologies themselves were good. Farmers considered this extension approach as a form of punishment by the colonial masters (Nhongonhema, 2010). The benefits of contour ridges were not recognized until after Zimbabwe attained its independence in 1980. The mandatory dipping of cattle was also viewed by farmers as forced extension and it was met with resistance.

2.8 Master Farmer (MF) Training Scheme

The Master Farmer Training (MFT) scheme originated in the 1930s with Alvord and its aim was to develop competent farmers (Pazvakavambwa, 1994) who would spread proven agricultural technologies in Communal Areas. A farmer would undergo a two-year training after which he/she would be awarded with a certificate and badge. The MF training approach assumes trickle-down of extension as the MF graduates were expected to pass on the received knowledge and technologies to other farmers in their communities (Hanyani-Mlambo, 2002). The program was also used to promote the use of hybrids among smallholder farmers. This did not produce satisfactory results because the increased surplus of crops could not be marketed. According to Chipika (1985) the MF
training changed in 1953 when the MF certificate became a main requirement for obtaining a farm in the purchase areas. An evaluation done by Chipika (1985) showed that the MF programme was oriented towards the training of ‘better-off’ farmers while poorer farmers were left out of the programme. As noted by Mutimba (1997), the MF training approach continues to be the core of AGRITEX’s work, despite its weaknesses.

2.9 Training and Visit (T&V)

The Training and Visit (T&V) extension system was developed for the World Bank by B ernor and Harisson (Bernor and Harrison, 1977). The idea behind it was to speed up the dissemination of Green Revolution technologies to farmers, targeting Asian and African countries (Swanson and Rajalahti 2010). The World Bank introduced the T&V system in many developing countries to make sure that extension efforts were well managed and properly organized. The aim was to ensure that agricultural extension was effective through structured training, delivery and administrative systems. Agricultural projects were supposed to strengthen the extension management system, improve the extension agent-farmer ratio by increasing the number of extension staff, and to provide basic support services to field extension staff. These support services included offices, housing, transportation, and extension materials. The T&V approach followed a hierarchical system where technologies were delivered from international and national research and extension centres and were passed on to subject matter specialists (SMS). The SMS would then pass the information to agricultural extension officers (AEO). The agricultural extension workers (AEW) based at Ward level would then get the information on agricultural technologies and then pass this to contact farmers. Contact farmers would then pass the information to all other farmers.
The T&V approach was designed to work with farmer groups instead of contact farmers in Zimbabwe (Mutimba, 1997). The T&V extension model was designed to work on a fortnightly basis in which the first week was used for training and the second one for visiting and evaluating.

As Hanyani-Mlambo (2002) argues, the T&V model only proved to work excellently in irrigated projects where strict timetables were followed. Not much progress was observed in dry-land crop production. The system could not continue to be effected because of limited resources and it was discovered that farmers do not follow strict timetables (Hanyani-Mlambo, 1997). Extension agents did not have adequate transport to conduct all prescribed visits to farmers every fortnight. It was also observed that there was an increase in the number of permanent extension workers, most whom were initially supported with project funds. Because of heavy financial requirements of the approach, SMS and AEO had little or no financial resources to plan and implement on-going extension programs (Swanson and Rajalahti, 2010). Another problem noted was that many AEW who were hired were inadequately trained to carry out complex extension activities.

2.10 The Radio and TV Agricultural Broadcasts

The radio and TV agricultural broadcasts model was designed to enable farmers in different geographical locations to listen to radio programs that would address their concerns (Mudiwa, 1997). Farmers would then discuss issues raised in the programs and assist each other to understand relevant concepts. The radio and TV agriculture programs became a popular mode of extension in Zimbabwe after the land resettlement program of 2000. Programs like “MurimiWanhasi/UmlimiWanamhla, Today’s Farmer” and
“Talking Farming” were aired in order to assist new farmers to deal with problems they were facing in the new farms. According to Marume (2010), the radio and TV agricultural broadcasts programs did not adequately address problems raised by farmers due to lack of experts on different subjects. Some of the issues raised in the programs were sometimes irrelevant to many of the smallholder farmers. Many of such programs were designed to benefit commercial farmers who could afford to hire experts at their farms anyway.

2.11 Community Based Extension Approaches (CBEA)

In Community Based Extension Approaches (CBEA) farmers take a very pivotal role in the dissemination of agricultural technologies. The idea is that farmers become extensionists and are involved in the dissemination of technologies to their peers. It is expected that farmers, if involved in the dissemination of technologies, become enthusiastic and their involvement will enable perfecting their farming skills (Bunch, 1990). The transfer of technology from one farmer to another farmer takes place through different means including informal conversations in daily life, through group discussions, during cooperative farming and while visiting each other (Bonye et al., 2012). One of the advantages of CBEA is that it can benefit from social capital of rural communities and farmers’ organisations (Feder et al., 2010). Social capital is defined by Hayami (2009) as the ‘structure of the informal social relationships conducive to developing cooperation among economic actors aimed at increasing social product, which is expected to accrue to the group of people embedded in those social relationships’. The active participation of farmers can also reduce the transaction costs of providing extension. Some of the CBEA that have been practiced include farmer-to-farmer extension approaches (Bonye et al., 2012, Bunch, 1990); participatory extension approaches, participatory rural
appraisals and farmer field schools (Hanyani-Mlambo, 2002). A major drawback of CBEA is that of collective action as described by Olson (1965): the benefits of extension advice are non-excludable; farmers have limited incentives to incur the transaction costs of participating in the organizational activities that are related to the establishment and management of the organisation (free rider problem).

2.12 Farmer Field Schools (FFS)

The Farmer Field Schools (FFS) was an extension model which originated in Indonesia in 1989, with the aim of assisting farmers to learn in an informal setting within their own environment (Davis et al., 2010). The FFS approach involves a season long, field based groups of 25-30 farmers who meet regularly to learn through discovery and experience (Khatam et al., 2010). FFSs are schools without walls where groups of farmers meet weekly with facilitators to:

- Learn and share experiences;

- Learn and develop agro-skills and farm management tools; implement four key principles of growing a healthy crop season-long monitoring the field regularly, conserving benefits and farmers becoming experts in their own fields (Bonye et al., 2012; Gallagher, 2003).

Learning in the FFS was based on experimental, participatory and hands-on work. Pimbert and Wakefield (2003) describe FFS as a form of social learning, negotiation and effective collection for and by farmers and their communities, focusing on society’s relationship with nature. The FFS was a more participatory extension methodology where farmers would fully participate in making decisions of what to do in their fields. In FFS
farmers are encouraged to develop their critical thinking leading to more empowerment and self-sufficiency (Coleman, 1990). It also been used as a tool to form community based organisations (Bonye et al., 2012). The FFS approach combines local and scientific knowledge and the main aim of the approach is to make farmers better decision-makers. FFS develops farmers’ skills and knowledge thus empowers them to choose appropriate soil and crop management practices (Khatam et al., 2010).

In Zimbabwe, the FFS started in 1997 with the introduction of integrated production and pest management (IPPM). The aim was to reduce the amount of pesticides that were used by farmers in crops like cotton, tobacco and vegetables (Barun and Duveskog, 2008). After FFS were used to assess IPPM in cotton production, most farmers concluded that they were over-using pesticides and under-using quality seed, irrigation and fertilizers. The FFS approach has also been used in soil, water and nutrient management technologies in Zimbabwe (FAO_SAFR, 2005). Rusike et al., (2004) hypothesized that FFS are more effective and efficient than traditional extension approaches in stimulating adoption of knowledge-intensive technologies such as soil fertility and water management.

The main strengths of FFS are that it is based on the principles of discovery-based learning and promotes the practical method of education (Khatam et al., 2010). Simpsons and Owens (2002) asserts that the FFS approach has made some significant progress in providing farmers with the opportunity to understand important ‘systems’, concepts and relationships. One of the weaknesses that were observed on FFS is that it requires noteworthy investments in time, training and other facilities (Roling et al., 2002). In other words, it is an expensive way of disseminating agricultural technologies.
2.13 Biological Nitrogen Fixation as a Soil Fertility Measure

Nitrogen is the most limiting nutrient for plant growth. Biological Nitrogen Fixation (BNF) is a process where legumes convert atmospheric N into the soil for use by the crops. According to Dupont et al. (2012), BNF is a major source of the biosphere nitrogen and as such has an important ecological and agronomical role, accounting for 65% of the nitrogen used in agriculture worldwide. Legume symbiosis plays a very important role in environmentally-friendly agriculture as it assists crops to grow on poor soils. Nitrogen-fixing crops contribute to nitrogen enrichment of the soil. The legume crops have been used in crop rotations to improve soil fertility (Dupont et al., 2012). The legume crops form a mutually beneficial (symbiotic) relationship with certain soil bacteria (Giller, 2001); the legume plants form an association with the bacteria (rhizobia) and the bacteria takes nitrogen gas from the air in the soil and transforms it into ammonia that converts to ammonium which can then be used by the plant. The nitrogen is fixed in nodules on the roots of plants. The ammonium is in the same form as ammonium nitrate (AN) or ammonium sulphate. In the rhizobia-legume interaction, the rhizobia bacteria provide the plant with fixed N needed for its growth. As the amount of N fixed can meet the needs of the plant and leave nitrogen in the soil for the following crops (Giller, 2001), BNF is a cheap technology to improve soil fertility that could improve livelihoods of smallholder farmers.

For effective nitrogen fixation, there is need for specific rhizobial bacteria that can form a symbiosis with specific legume crops. To ensure the availability of correct bacteria species for N-fixation on a specific legume crop, there is sometimes need for inoculation, such as often the case with soya bean, which is the addition of the rhizobial bacteria to legume seeds (Dupont et al., 2012).
2.14 Effectiveness of Extension Services in Technology Dissemination

FAOUN (1997) defines effectiveness as a measure of programme impact as compared to intended goals. In Mott (1972) effectiveness is defined as the ‘ability of the organisation to be mobilised to meet demands in the areas of production, adaptability and flexibility’. For impact to be measured the organisations must collect impact data. According to Prokopenko (1987) effectiveness is the ‘degree to which goals are attained’. FAOUN (1984) stated that “Effective extension work requires management and operational procedures that reinforce organisational structure.”
CHAPTER THREE

3. RESEARCH METHODOLOGY

3.1 Methodological Issues, Methods and Study Area

Survey research is one of the essential areas of measurement in applied social research (Tromchim et al., 2006). Marsh (1982) defines a survey as an investigation where systematic measurements are made over a series of cases and where variables in matrix are analysed to see if they show patterns. The areas of survey research embrace any measurement that involves asking questions from research participants, interviewees or respondents. Surveys are divided broadly into questionnaires and interviews. According to Tromchim (2006), questionnaires are completed by respondents, while during interviews, the interviewers complete questionnaires from what the respondents say.

3.2 Study Site

This section discusses the extent to which the LFA has been implemented in Zimbabwe under the N2Africa project. It then focuses on Goromonzi district as the study area.

3.2.1 Goromonzi District

The study was conducted in Goromonzi district where the project was being implemented by Cluster Agriculture Development Services (CADS) in collaboration with International Centre for Tropical Agriculture (CIAT). The district lies in Mashonaland East province is a peri-urban rural area in Zimbabwe located about 32 km south east of Harare (see Figure 2). To the north, the district shares borders with Bindura, Mazowe and Shamva.
districts, Harare to the west, Murehwa to the east and Marondera to the south. 4% of the population lives in urban area (Zimbabwe Census, 2002). The district is divided into 25 wards; 12 wards in the communal areas, and the remaining 13 wards form the new resettlement area. The district is largely covered by Highveld Prime Cereal and Cash Crop Resettlement Zone (FAO, 2013). Most soils in this zone are fertile and the district enjoys averagely high levels of annual rainfall of 750-1000 mm. However, most communal wards lie along marginally poor soils. The main constraints in rural communities include lack of access to agriculture inputs, labour and infrastructure (FAO, 2013). The major food and cash crops being grown in Goromonzi are maize, tobacco, soya beans and groundnuts. Households rely on crop production for food and cash income, in addition people do horticultural gardening, petty trading and casual labour (FAO, 2013).
Figure 2: Map of districts in Zimbabwe
3.3 Sampling Design

3.3.1 Study Area Selection

Goromonzi district was purposely selected for the study. It is one of the districts where the N2Africa project was implemented using the LFA. The project was implemented in the district in three consecutive seasons since 2010. The principle of the LFA was uniform among all the districts where the N2Africa project was implemented. It was decided to concentrate on one district in the study because it was not feasible to work on all districts given the necessity to do in-depth study and at the same time the limited time available.

Focus was then placed on one province, one district and five wards, namely Munyawiri Mawanga, Shumba, Murape and Pote. These wards are situated on the north-western part of the district in Chinamhora area (see Figure 3).
Figure 3: Map of Goromonzi District showing location of Wards

Wards 1-5 of Goromonzi District
The N2Africa project was targeting districts and wards where legumes could be successfully produced so that the subjects of BNF would then be taught to farmers who would then implement BNF and soil fertility technologies in their fields. The LFA was being implemented in the above-mentioned wards, which are located on poor soils in the northern area of the district. A list of all farmers who were in the project in 2010 was collected from CADS. The study population comprised of 50 Lead Farmers and 950 follower farmers. Out of the 50 lead farmers, 20 were selected using a simple random sampling technique from which five follower farmers who belonged to an individual farmer’s group were also randomly selected. In this way, 100 of the 950 follower farmers from the 2010 season were selected for this study. The total number of follower farmers selected was 110 to cater for those who would not be located during the study.

3.4 Methodology

3.4.1 Quantitative Research

A quantitative study may be defined as “an inquiry into a social or human problem, based on testing a theory composed of variables, measured with numbers and analysed with statistical procedures in order to determine whether the predictive generalisations of the theory hold true” (De Vos, 2005). The main aim is to systematically gather information that is measurable and that can be analysed statistically. Quantitative research is able to eliminate the confounding influence of many variables, allowing one to establish credible cause-and-effect relationships (Duffy, 1985). Data collection is relatively quick and the researcher can cover some ground with fewer resources over a short period of time. Analysis of quantitative data is less time consuming as compared to analyses of some of
the qualitative data. The precision of quantitative research makes the researcher to analyse and evaluate independent and dependent variables in detail.

Methods
The survey was conducted using a structured questionnaire to collect data (see Appendix I). The questionnaire had nine main table questions with several sub-questions in each table. Most of the questions were close-ended and pre-coded. A likert scale was used to capture views and opinions of the respondents. The questionnaire used for collection of information from the respondents had three main sections that covered the main objectives of the study, namely:

3.4.2 Qualitative Research
According to Parkinson and Drislane (2011), qualitative research is “research that uses methods such as participant observation or case studies which result in a narrative, descriptive account of a setting or practice”. Denzin and Lincoln (2005) stipulate that qualitative research is a situated activity that locates the observer in the world and it consists of a set of interpretive, material practices that makes the world visible. In qualitative research, the researcher uses an interpretive and naturalistic approach to the field of study. Things are studied in their natural settings and the researcher attempts to make sense and interpret phenomena in terms of the meanings people bring to them. The main advantage of using qualitative approach in data collection is its ability to study phenomena which are simply unavailable elsewhere.

Methods
The qualitative methods employed in this research include informal interviews, observation and focus group discussions. The informal interviews were done in order to
have a better understanding of the issues surrounding the lead farmer approach as it affects the follower farmers. The LFA as a concept which is being promoted to ensure that farmers play an active role in agricultural extension is relatively new in Zimbabwe.

3.4.3 **Key Informant Interviews**

The study targeted field officers from CADS and AGRITEX, who were involved in the implementation of the N2Africa project. The selection as solely based on degree of involvement in the formation of farmer groups, selection of lead farmers and training of the lead farmers on soil fertility technologies. In Goromonzi Mr Leonard Kuwona (CADS Project Manager) was key during the survey since he was the officer responsible for the implementation of the project and as such had very detailed knowledge on the implementation and the people involved. Ms Isabel Magama (AGRITEX Officer) was very instrumental in the training of lead farmers and follow-up on the follower farmers during the cropping seasons. In each ward there was one CADS field officer and two AGRITEX officers who were interviewed. The total number of key informants interviewed was 15.

3.4.4 **Field Observation**

During the implementation of the project, the researcher was making field observations on the farmer groups, how they were conducting their group activities and farming systems. The observations were recorded in field notebooks. The notes helped in coming up with a generalised outlook of the socio-economic and farming systems of smallholder farmers in Goromonzi district.
3.5 Data Entry and Data Analysis Procedures

Two statistical packages for data entry and data analysis were used. The Statistical Package for Social Scientists (SPSS) version 20.0 was used for both data entry and most of the data analysis. Stata 12.0 was used in the analysis for the t-test statistics. SPSS was used because it is easy to use, and it can be used to manage data as well as to calculate a wide range of statistics. One can compute other variables using variables that are obtained from the field. Also syntaxes can also be performed to avoid statistical operations all over again after an error has arisen or when one wants to revise some section of the output. SPSS can be used to construct bar graphs and pie charts and also to perform T-test, linear regression analysis and correlation.

3.6 Operationalization and Definition of the Variables

As indicated in Chapter One, the study sought to evaluate the effectiveness of the LFA as it was implemented by the N2Africa project in Zimbabwe. Effectiveness was defined as the ability of the taught farmers to demonstrate and practice what they have been taught by their lead farmers. In this study the main outcome measured was to estimate the increase in knowledge of the follower farmers which they had gained in the trainings. The level of increase was measured by asking follower farmers to rate the levels of understanding of different subjects taught by the lead farmers using a likert scale.

A likert scale is a composite measure developed by Rensis Likert, in an attempt to improve the levels of measurement in social research through the use of standardized response categories in survey questionnaires to determine the relative intensity of different items (Babbie, 2009).
Follower farmers (respondents) were asked to rate their level of understanding of the different soil fertility subjects taught and they used the likert scale to rank these. The following five point scores were used to rate them: 1=very poor, 2=poor, 3=fair, 4=good and 5=very good. These were then used to determine the change in level of understanding by computing the scores after minus the score before for each subject taught.

There were eight main subjects that were taught to the respondents during the implementation of the N2Africa project using the LFA. All these had to do with improving soil fertility status among smallholder farmers:

i) General agronomy (Gagr)

ii) Specific legume agronomy (Spagr)

iii) Intercropping and crop rotation strategies (IntRot)

iv) Biological nitrogen fixation (BNF)

v) Knowledge of the importance of nodules in soil fertility (NodK)

vi) Identification of effective and ineffective nodules in the roots of legume crops (EffNod)

vii) The theory of inoculation (InocT)

viii) Inoculation practical (InocP)

Furthermore, the researcher listed possible indicators of effectiveness that would be used by the respondents to measure the effectiveness of the approach. The indicators were derived from literature and are usually used to measure efficiency and effectiveness of agricultural extension. According to Bentz (1998), these extension performance
indicators reflect extension’s operational and technical effectiveness. The indicators are listed in Appendix 1.

Although the eight main subjects taught in the N2Africa project are listed above, it was also important to identify the most important subjects that were taught by lead farmers, from the follower farmers’ point of view, despite how bad or good they were being taught and despite whether N2Africa had considered these important or not.

3.7 Analytical Section

The data were entered, cleaned and then analyzed using SPSS version 20. Paired sample T-Tests were used to compare the levels of knowledge before and after the trainings and Stata version 12 was used to perform this analysis. The study applied multivariate linear regressions analysis to identify factors that influence the effectiveness of the LFA for extension messages and impact on farming practices of smallholder farmers.

In this study, proxies for household demographic and socio-economic characteristics age of the respondent, sex of respondent, sex of household head, level of education, marital status, main occupation of household head, household size, farming experience and land size were used. (see Table 1). According to Birnar et al., (2006) the characteristics of local communities play a crucial role in design and implementation of an extension system. Homogeneity or heterogeneity in terms of age, land holdings and assets, household size, level of education and other factors influences the capacity of farm households to cooperate in extension services. In the same vein, it is important to look at how these factors influence the effectiveness of an extension approach.
Table 1: Socio-economic variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Expected sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>RespAge</td>
<td>Age of respondent</td>
<td>+</td>
</tr>
<tr>
<td>Respsex</td>
<td>Sex of respondent (1=male, 0=female)</td>
<td>+/-</td>
</tr>
<tr>
<td>HHeadsex</td>
<td>Sex of household head (1=male, 2=female)</td>
<td>+/-</td>
</tr>
<tr>
<td>Headeduc</td>
<td>Education level of household head (1=no education, 2=primary, 3=secondary, 4=university)</td>
<td>+</td>
</tr>
<tr>
<td>Marital status</td>
<td>Marital status of household head (1=single, 2=married, 3=divorced, 4=widowed)</td>
<td>+/-</td>
</tr>
<tr>
<td>Occupation</td>
<td>Main occupation of the household head (1=farming, 2=regular non-farm wage employment, 3=small-scale business, 4=other, specify)</td>
<td>+/-</td>
</tr>
<tr>
<td>HHsize</td>
<td>Total number of members in the household</td>
<td>+</td>
</tr>
<tr>
<td>Land size</td>
<td>Total size of land in hectares</td>
<td>-</td>
</tr>
<tr>
<td>Farmexprience</td>
<td>Total number of years the household has been farming</td>
<td>+</td>
</tr>
</tbody>
</table>

3.8 Socio-economic Variables and Farming Systems

The socio-economic variables and farming systems that were used in determining the effectiveness of the LFA were all obtained from literature. From past studies, it has been observed that the socio-economic and farming systems, together with policy environment, capacity of potential service providers and other community aspects have an influence in the design and implementation of an extension system (Birnar et al., 2006). This study
focussed on socio-economic variables and farming systems of farmers in Goromonzi district in determining the effectiveness of the LFA.

### 3.8.1 Age of Respondent

Age is the proxy of the farming experience of the respondent. As the age of the farmer increases, the farmer may also want to gain more knowledge in farming and therefore participate in agricultural extension activities. Young farmers are more likely to engage in extension services so that get new agricultural technologies. These farmers also are the ones who actively participate in rural development projects and they are willing to gain knowledge on technologies. In this study, young farmers were those who are in the economically productive age (25-55 years). As the farmer gets older, at ages above 55 years, the interest in farming goes down. Okon and Enete (2009) argue that older people are risk averse and may not want to experiment ‘these new technologies’. Younger people are stronger than the elders and can perform tougher jobs in field. According to Okon and Enete (2009) younger farmers are more dynamic, with regards to the adoption of innovations that would enhance their productivity. They may need to participate in new technologies and also join farming groups, especially associated with development organisations. As such, the researcher expects a positive relationship between the age of respondents and increase in knowledge.

### 3.8.2 Sex of Respondent

Sex of the respondent is the proxy of gender. The sex of the respondent here refers to the sex of the follower farmer who was actively responsible for the implementation of N2Africa related activities. It is worth noting that more women than men participate in development projects. Women play a very significant role in rural development projects and agricultural extension. The aim of the N2Africa project was to promote legume crops
(sugar beans, groundnuts, soya beans and cowpeas) and these are usually referred to as women’s crops because it is often the women who tend to these crops. Agricultural projects and extension are also designed to target women because they are the ones actively involved in providing most farm labour and making the key decisions for many agricultural activities. According to FAO (2010), women in Sub-Saharan Africa are participating more in agricultural projects and as such they gain more knowledge about farming. However, Doss and Morris (2001) argue that women in Sub-Saharan Africa show relatively low rates of increased knowledge after technologies have been disseminated to them. In this study the researcher expects a positive relationship between female gender of farmers and increase in knowledge. The study also expects the majority of the respondents to be women.

3.8.3 Farming Experience

Farming experience was measured as the number of years the farmer has been farming independently. According to Okon and Enete (2009) farming experience has a positive relationship with increase in knowledge. This indicates that more experienced farmers have greater interest in learning new technologies and this will enhance better management of their natural resource, the land. Experienced farmers may be more knowledgeable in agricultural production and may therefore be better able to assess and manage the risks involved in the system than inexperienced ones. Farming experience and skills are strong predictors of good performance (Chiremba and Masters, 2003). The researcher expects a positive relationship between farming experience and increase in knowledge of the follower farmers.
3.8.4 **Sex of Household Head**

Household head refers to the member of the household who actually controlled the productive resources of the family such as land, inputs, etc., and provided the main economic support of the family. This exclude heads of households working away from the homestead, for example in towns. These persons were classified into two groups: male and female. The sex of the household head is also a proxy of gender. As Doss and Morris (2001) argue, women’s level of participation in agricultural technologies depends on whether the intended projects have can have potential cash benefits for the household. Female-headed households are more likely to participate in rural development programs and soil fertility programs than male-headed households. The researcher expects more female-headed households to have an increased level knowledge than male ones.

3.8.5 **Education of Household Head**

The socio-economic variable ‘education of household head’ refers to the highest level of formal education reached in the household. It was measured using three categories: no education (the respondent never attended any formal education), primary education (primary completed/not completed) and secondary (secondary completed/not completed). Education is a human capital and it is very important in the determination of important factors in the adoption of agricultural technologies. Education improves access to information and the use of attained knowledge. Education level also enhances the objective contribution of farmers to whatever type of technologies that are being promoted. According to Fichman (1992), for any increase in knowledge to take place, the participants need to have some basic level of education so that there is impact on what is learnt. There is an increased level of understanding among farmers who have undergone some formal training on technologies as compared to those who have never attended any
school. Learned households are more likely to receive knowledge and use it. Such households are assumed to have a quick understanding of soil fertility issues and can easily participate in extension activities. Feder et al. (1985) relates the education level of the farmer with allocative ability, which is the ability of the farmer to adjust to changes. Huffman (1977) argues that farmers with higher levels of education possess higher allocation ability and adjust fast to new technologies. He also noted that education is important especially when extension activities are less intense. The researcher expects a positive relationship between the level of education and the increase in knowledge.

3.8.6 Marital Status of the Household Head

This referred to the marital status of the household and it took into cognisance whether the spouse was resident at the homestead or not. They also included polygamous homesteads where the female spouses would be household heads. These were categorised into four groups: single, married, divorced and widowed. The marital status of the household head provides an indication of who makes decisions between husband and wife in a married couple set-up while the single divorced and widowed household heads are the sole decision-makers. The main assumption here is that in a married set-up, the male is always the household head and makes most of the decisions in farming. Decisions may be done jointly, but the husband always has the final say on farming matters. It has emerged recently that in female-headed households that are much involved in agricultural technologies most of extension work are designed with women in mind (Doss, 2001). In households where there are married couples, decision making may be bring some conflicts and this may affect the participation of one spouse in extension. As Doss (2001) puts it, policies or technologies that affect how a family controls natural resources in the household may affect the outcome of household decisions, including the implementation
and adoption of agricultural technologies. Because men and women perform different tasks and have different access to household labour, the gender of the farmer may affect the adoption of technologies. The researcher expects a negative relationship between male-head households and increase in knowledge.

### 3.8.7 Main Occupation of the Household Head

This referred to the main means through which the household head derives his/her family’s livelihood. The categories in this group were farming, regular non-farm wage employment, small-scale business and other which the respondent would specify. The main occupation of the household head has a very important link to whether the family can and aims to fully participate in agricultural activities or not. If the household is getting most of its income from elsewhere other than farming, then it is likely that there is limited participation in the extension services. Households that take farming as their main occupation, are more likely to have a greater desire to learn more about farming so that they improve soil fertility and increase their yields for better livelihoods. Increase in farming knowledge will lead to more participation in agricultural activities and better soil fertility management. The researcher expects follower farmers who take farming as their main occupation to have more increased knowledge.

### 3.8.8 Household size

The refers to the total number of people who formed the household. This was achieved by recording the total number of people who normally feed from the same pot in the household. Household size is a proxy of available labour in the household. According to Doss and Morris (2001), one of the major constraints faced by farmers to participate in agricultural extension activities is labour availability. Household labour reflects the human capital resources that are available to carry out agricultural activities. Bogale and
Shimelis (2009) noted that households with large pools of labour are more likely to participate in all extension activities and they are able to execute agronomic operations on time. Everything learnt from the extension can be fully implemented. There is a positive correlation between household size and knowledge increase.

3.8.9 Land size

This refers to the total number of hectares that were available for arable cropping in the household. Decisions about farmer participation, increased knowledge and technology adoption are affected by access to land and the security of the land tenure system. Those who own land strive to learn more so that they can keep their land more fertile so that it will continue to produce yields (Doss and Morris, 2001). Farmers with smaller pieces of land strive to learn on how they can intensively use their smaller lands. It is thus expected that farmers with little pieces of land are more likely to have increased knowledge.

3.9 Measuring Process Variables

Process variables were the variables that were used by the follower farmers to evaluate how effective the lead farmer approach was. These were sub-divided into three main themes; meetings, information dissemination and personal characteristics of the lead farmer that would contribute to effectiveness of the lead farmers in the delivery of agricultural technologies.

3.9.1 Meetings

Methods of conducting meetings (Methods): The lead farmers were free to use any method of meeting with their follower farmers. The methods included formal gatherings at lead farmers’ fields, formal classroom meetings, taking advantage of informal gatherings in the locality, individual farmer visits, and the follower farmers visiting the
lead farmer. The methods of conducting meetings are important in that farmers respect the extension approach which is more formal. The researcher would expect the lead farmers to use formal farmer gatherings at the lead farmers’ fields and he would also expect these methods used to be effective.

**Organising meetings** (Organising): According to Waldron *et al.* (1998), ‘organising’ refers to the establishment of structures and systems through which activities are arranged, defined, and coordinated in terms of some specific objectives. Organisation of the farmers by the lead farmer would facilitate ways in which different activities would be done to achieve a process of learning and acquiring knowledge by the follower farmers. It is also expected that the lead farmers would be effective in organising meetings with the follower farmers.

**Starting and ending Meetings at agreed times** (StartEnd): The time of starting meetings and ending the meetings is very important to farmers since they always have a lot of other things to do. During the farming season, the farmers would want to be doing agricultural activities and other household chores and they would not expect meetings to extend unnecessarily. Lead farmers do form part of this community of people who would need to perform their agricultural activities on top of organising meetings and conducting trainings for their follower farmers. It is thus expected that the approach of starting and ending meetings at agreed times would be effective in as much as meetings are concerned.

**Frequency of meetings** (Frequency): Frequency of meetings is the number of times the farmer groups meeting with the lead farmer per month to discuss or train on agricultural technologies pertaining to soil fertility. The number of visits could be no visit all, once, twice, thrice or four times a month. In the design of the T&V systems the extension agent
was supposed to meet with farmers at least twice a month (Hanyani-Mlambo, 2002). Fortnightly meetings of the farmers in their groups would be considered as an effective frequency of farmers’ meeting for specific extension activities. It is expected that a higher frequency of meetings would increase the effectiveness of the LFA.

**Regularity of visits to follower farmers** (Regularity): The lead farmers were expected to pay regular visits to their follower farmers’ fields to see if they were putting into practice what they were taught. Visits by lead farmers could instil confidence in the follower farmers and they would want to continue practicing what they are taught. Regular contacts between follower farmers and their lead farmers create an enabling environment that allows the farmers to ask about and discuss problems that they may be facing at their individual farms. The researcher also expects the lead farmers to regularly visit their follower farmers.

**Punctuality in attending meetings and demonstrations** (Punctuality): Punctuality is a proxy for time management. Follower farmers will have confidence in lead farmers who are time conscious and punctual. It is expected that the lead farmers will be punctual in attending all meetings and demonstrations.

**Careful planning of cultivation activities** (Planning): Planning is the process of determining organizational aims, developing premises about the current environment, selecting the course of action, initiating activities required to transform plans into action, and evaluating the outcome. Planning is a major contributor for success and performance. Agricultural activities need to be well planned so that the activities are performed at the very right time. Delayed planting will result in decreased yields, so the lead farmers are expected to do careful planning of activities. Activities of importance that required careful
planning included inoculation of seeds, planting, weeding of the fields, identification of nodules in the field and also field days. It is expected that there would be careful planning for the Lead Farmer Approach to be effective.

3.9.2 Information Dissemination

The lead farmers were trained on agricultural technologies by extension staff and NGO partners field staff and they were supposed to deliver the knowledge on these technologies to their group members. The following factors on information dissemination with which the follower farmers were supposed to evaluate the LFA, were both theoretically and empirically determined by the researcher:

Establishing demonstrations (Establish): The N2Africa project had a component of demonstration where lead farmers were supposed to establish demonstration plots in their fields. Follower farmers would come and learn about the effects of different soil fertility amendments that were being demonstrated on the plots. An example of demonstration plot would one a soya bean plot with four subplots (see Figure 4). In each of the subplots different fertilizer treatments would be applied so that farmers would easily understand the effects using fertilizers and inoculants in the production of soya beans.
Inoculants are agricultural amendments that are used to enhance soil fertility among legume crops. The inoculants contain living bacteria (rhizobia) which attach to the roots of the legume crops and these fix nitrogen from the air into the roots of the plants for the benefit of the plants. This is called biological nitrogen fixation.

**Inviting follower farmers to demonstrations (InviteFF):** The LFA as an extension strategy involves inviting follower farmers to demonstration plots so that they would participate in training activities and also learn how to practically use the technologies they were trained on. Follower farmers would learn as a group from the lead farmer at his/her demonstration plot and then they would go and practice what they would have learnt in their own fields. Effectiveness of the approach would also be assessed by the ability of the lead farmer to invite follower farmers to invite his/her follower farmers to the demonstrations.

**Explaining protocols (Protocols):** Effectiveness of an extension approach includes the ability of the extension agent to explain about technologies in an understandable manner.
The lead farmers were also evaluated on the basis of how they effectively explained different protocols used in the demonstrations. It is expected that the lead farmers would explain the protocols depending on how they would have understood these protocols during the trainings and it was also a measure of the facilitation skills of the lead farmers.

**Ability to demonstrate technologies (Demonstrate):** The ability of the lead farmer to demonstrate technologies was an indication of the facilitation skills of the lead farmer. Lead farmers who can effectively demonstrate what they have been taught can more easily transfer knowledge to their follower farmers and this makes an approach effective. It is thus expected that lead farmers were effective in demonstrating technologies.

**Interaction with follower farmers (Interaction):** Interaction with farmers in extension helps the extension agent to understand farmers better and this may help the agent to know individual farmer’s challenges so as to make appropriate recommendations to the farmers. If the lead farmer interacts more with farmers there is more social capital created which makes an extension approach more effective. If there is poor interaction between the lead farmers and follower farmers, this may act as a barrier to the transference of technologies no-matter how the lead farmers can explain protocols and demonstrate technologies. It is expected that the lead farmers were assisting follower farmers at individual level – as an indication of the effectiveness of the LFA.

**Ability to solve follower farmers’ problems (SolveProb):** The lead farmers were trained in soil fertility and other agricultural technologies in order to help follower farmers overcome challenges in these areas. It was expected that lead farmers were experts in the trained subjects and would be also assessed on their ability to solve their follower farmers’ agricultural problems.
Allowing farmers to discuss soil fertility problems (DiscussProb): One of the attributes that make agricultural extension participatory is the ability of the agricultural extension agents to allow farmers to discuss problems that they are facing and coming up with solutions. The lead farmers, after being trained, would need to let follower farmers discuss their individual problems with each other.

General performance in Dissemination (Performance): Performance is the degree to which a development intervention or a development partner operates according to specific criteria/standard/guidelines or achieves results in accordance with stated goals and plans (FAO, 2010). General performance was a measure of the efficiency of the lead farmer in terms of the actual number farmers that were reached per season, the relationship between the lead farmer and extension, number of trainings conducted, field days conducted and the degree to which the lead farmer coordinated the group. It is expected that the lead farmer was effective in general performance.

3.9.3 Personal Characteristics

Personal characteristics were included in measuring effectiveness to assess the lead farmers and their dedication to their duties. Four attributes were considered: altruism, reliability, patience and commitment.

Altruism is the selflessness behaviour, considering other people’s concerns without expecting any reward and doing things simply out of a desire to help. The lead farmer is expected to work with his or her follower farmers and train them without expecting any returns and for the LFA to be effective there is need for some degree of altruism. Wabab et al. (2011) comments that principles of altruism are key to agricultural extension delivery systems.
Reliability of the lead farmer referred to the dependability of the lead farmer in the provision of extension services. Consistency of the lead farmers in performing their duties means that they are a reliable source of agricultural information. According to Munyua et al. (2002), having a sustainable information system requires that information sources are reliable, offer practical alternatives and are an on-going activity. To keep up with farmers’ needs, extension systems need to be continuously updated with viable alternatives for farmers’ agricultural practices.

Patience is one of the attributes that enable farmer-extension agents and farmer-to-farmer extension to be successful. Pretty and Uphoff (2002) suggest that patience is one of the preconditions that facilitate learning in a participatory manner. Oladosu and Okunade (2006) listed patience as one of the important attributes that extension agents should have in order to effectively deliver agricultural technologies to farmers. In his study on farmers’ perceptions of agricultural extension agents Oladele (2005) also listed patience as one of the important characteristics that extension agents. The researcher expects the lead farmers to be patient with their follower farmers.

Commitment is an indication of the lead farmer’s dedication to the work of agricultural extension. Committed lead farmers make sure that technologies are fostered by follower farmers and they are being practised. Commitment also means that lead farmers take responsibility to make sure that the objectives of the programs at hand are fulfilled. The researcher expects that the lead farmers were committed in their duties.
3.10  Dependent Variables

3.10.1  Follower Farmers’ Perceptions of Technology Dissemination

Effectiveness is defined as the ability of the lead farmers to deliver agricultural technologies that could result in the increase in the knowledge of the follower farmers. The lead farmers were using different methods which were then evaluated by the follower farmers to come up with scores on effectiveness.

The first dependable variable was the follower farmers’ perception on how the lead farmers disseminated soil fertility technologies. It was measured by scoring how lead farmers performed their duties. These were the process variables used to measure effectiveness. The process variables were divided into three main themes which included meetings conducted, how information was disseminated and the personal characteristics of the lead farmers. All these were measured by use of score rankings of 1 to 5; 1=very poor, 2=poor, 3=fair, 4=good and 5=very good. The follower farmers’ perception on how the lead farmers conducted their extension activities were recorded by Bentz (2008) as extension effectiveness indicators.

3.10.2  Increase in Knowledge

The other dependable variable in the study was the increase in knowledge that was attained by the follower farmers after they were taught by the lead farmers. The increase in knowledge of the follower farmers was obtained by asking the follower farmers on the level of knowledge they had before their involvement in the LFA and after. The level of knowledge was ranked on a score of 1 to 5 as follows: 1=very poor, 2=poor, 3=fair, 4=good and 5=very good. The main subjects that were being taught by the lead farmers are listed on section 4.1 above. Follower farmers were asked to rank their level of
knowledge before and after the trainings. Then the knowledge scores were computed to find the change in knowledge on the different subjects taught.

The change in knowledge was obtained by the subtracting the mean knowledge score before and after the training for each subject taught. This was done to obtain the change index (changeindex) in the knowledge of the farmers for each subject taught. The total change index was obtained by summing all change indexes for the subject taught. The minimum score for each subject was 1 and the maximum score was 5. So the minimum score index to be obtained would be 1 and the maximum score index would be 4 (score after minus score before). A score index of 1 would mean that the respondent would not have gained any knowledge from the trainings whilst a score of 4 would mean that the respondent would have a maximum increase in the knowledge. So the dependent variable is the change index in the level of knowledge.

The following data analysis procedures were performed during the analysis of the results to answer the formulated research questions and objectives of the study:

**Grouped Bar Graphs and Cross Tabulations:** Crop tabulations were used to present data on the interaction between main occupation of the household head and household land arable land size. Tables give a quick pictorial view of the differences between variables.

**T-Tests:** There was need in the study to determine whether there is a significance differences in the level of understanding of the soil fertility technologies before and after the LFA was employed in the dissemination of these technologies. T-tests were used to determine which of the subjects were rated as indicated some significance differences in the way farmers understood. Paired sample T-Tests were used to evaluate the differences
between the mean scores of the level of understanding of farmers before and after the LFA was implemented.

**Linear regression:** Linear regression was used to investigate the relationship between the change in knowledge of follower farmers and the different independent variables. I wanted to find out which variables adequately and significantly explain the change in the level of understanding of follower farmers. This would assist in searching for the main factors that contribute to the adoption of soil fertility technologies by farmers after some extension methodologies have been used.

### 3.11 Ethical Issues during the Research

Professional research is guided by principles from the start of the research through to completion and publication of results (ESRC, 2010). Research ethics refer to a complex set of values, standards and institutional schemes that help constitute and regulate scientific activity (National Ethics for Research Ethics in Norway, 2005). Ethical principles are there to protect research participants, institutions and researchers so that ethically inappropriate behaviour by researchers will be prevented. Ethics also help prevent researchers from conducting research that could tarnish their reputations.

This study was guided by the ethical principles developed by the Nuremberg Code. The philosophy was to make sure that the interests, rights and values of the participants or respondents were protected throughout the survey:

- Voluntary consent of the human subject was utmost important.
- The research was conducted in such a way that all unnecessary physical and mental suffering and injury were avoided.
• Proper preparations were put in place so that even the remote possibilities of harm to human subjects would be avoided.

• During the course of the study the respondents were at liberty to bring the study to an end if they had reached the physical or mental state where continuation seemed not possible for them.

• During the course of the enquiry the researcher was prepared to terminate questioning at any stage, if he had thought to believe that the continuation of the experiment was likely to result in injury of the subjects in terms of physical harm; harm to participants’ development, loss of self-esteem and stress.

The researcher also ensured that the enquiry could not result in raising false hopes and undue anxieties to the respondents. The project, being part of the implementation of the project, would falsely raise hopes to the respondents that they would get more inputs from the project. The researcher clearly explained the purpose of the study to the respondents. He explained clearly that he did not come to conduct the study as an implementer of the project but rather as a university student. He pointed out that research was an academic one and there was no other intended use. Provision of student ID card also helped to convince the respondents. He also assured the respondents that the information collected was confidential.

It is also important to note that the researcher first sought the approval of the local chiefs and village heads to be allowed to conduct the survey.
3.12 Limitations of the Study

The study was conducted in five wards located in one district which is a peri-urban area. Households which are near town centres are often tempted to look for jobs in the nearby town and may have sources of livelihood other than farming. However, it was noted that although the district is nearer to town, most households derive their income from farming and selling their crops in Harare.

While the LFA was implemented in seven districts in Zimbabwe, the study was implemented in only one. It would be imperative to conduct the study in districts with soil fertility properties and agro-ecological potential different from Goromonzi to get the different views of follower farmers on how the approach was used in those districts.

One more limitation was that the researcher was well known in the district and this may have contributed to subjects to respond in a biased manner. To counteract this limitation, the researcher, with the trained enumerators in the area, explained to the village heads that the respondents needed to give their honest opinion on how they had viewed the LFA so that this would inform other projects that would use the same approach in the dissemination of agricultural technologies.

The research was carried out during the time when national elections were about to be conducted. During this period, no outsiders from the district were supposed to be seen talking to farmers because they were thought to be campaigning for the opposition parties. The researcher had to seek authority from the Mashonaland East Provincial Administrator, Goromonzi District Administrator and Goromonzi Rural District Council in order to carry out the study. This took a lot of time since all were busy preparing for the elections and they also were hesitant to authorise the research to go on.
CHAPTER FOUR

4. RESEARCH FINDINGS AND DISCUSSION

4.1 Socio-Economic Conditions

Table 2 below shows the demographic characteristics of the respondents. Information shown includes sex of the respondent, sex of the household head, marital status of the household head, age of the respondents and the level of education of the respondents. This information is important since it captures the socio-economic status of the respondents and how the status of the respondents influence the LFA as an extension strategy employed in a particular area.

4.1.1 Socioeconomic and Demographic Characteristics of respondents

Table 2 and Table 3 below show the demographic and socio-economic characteristics of the respondents. Table 2 reveals the percentages of the different demographic categories of the respondents while Table 3 show the mean, standard deviation, minimum of and maximum recordings of the continuous demographic characteristics of the respondents.
Table 2: Demographic Characteristics of Respondents (percentages)

<table>
<thead>
<tr>
<th>Demographic Characteristics (n=100)</th>
<th>Category</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex of Respondent</td>
<td>female</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td>male</td>
<td>27</td>
</tr>
<tr>
<td>Sex of Household Head</td>
<td>female</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>male</td>
<td>62</td>
</tr>
<tr>
<td>Marital Status of household head</td>
<td>single</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>married</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td>divorced</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>widowed</td>
<td>35</td>
</tr>
<tr>
<td>Level of Education of Respondent</td>
<td>no education</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>primary</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>secondary</td>
<td>60</td>
</tr>
<tr>
<td>Main Occupation of Household head</td>
<td>farming</td>
<td>81</td>
</tr>
<tr>
<td></td>
<td>regular-non farm wage</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>employment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>small scale business</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>petty trade</td>
<td>2</td>
</tr>
</tbody>
</table>
Table 3: Age, household size, labour and farming experience with mean and standard deviation

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>53</td>
<td>12.76</td>
<td>27</td>
<td>89</td>
</tr>
<tr>
<td>Household Size</td>
<td>5.07</td>
<td>1.81</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Labour</td>
<td>3.18</td>
<td>1.44</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Farming Experience</td>
<td>19.56</td>
<td>12.79</td>
<td>2</td>
<td>50</td>
</tr>
</tbody>
</table>

The results in Table 2 show that 73% of the respondents were female. It is usually men who participate in agricultural extension activities in Zimbabwe. They usually go and attend extension meetings but women do most of the agricultural activities in the fields. When the key informants were asked about the high percentage of women participating in the extension of agricultural technologies, they indicated that women are now very active in farming activities. In most cases when field officers of partner organisations and AGRITEX visited farmers, they rarely found men at their homes or farms. According to key informants, involvement of women in the project was also brought about by the fact that the crops being promoted in the lead farmer approach are legumes and they are referred to as women’s crops. Goromonzi district is nearer to the capital Harare and therefore a large number of men go to the city to look for jobs while they leave their wives to carry on with farming businesses. When asked why there were more women participating, one farmer indicated that it was one of the requirements of the project to
promote more women participating in the project so that they could learn about how to grow legumes for soil fertility improvement, food security and household food nutrition. Another issue raised by one of the respondents was that the groups were formed after considering other activities being done by the farmers, like gardening. The farmer said, “We wanted to make sure that all follower farmers and the group had the same interest – horticultural gardening and marketing our produce together in Harare”.

In this study, all the respondents were actively involved in N2Africa project activities and were all Follower Farmers. This indicates that most of the project beneficiaries in Goromonzi were women. Most of the households were male-headed (62%). As shown, most men allowed their wives to participate in the N2Africa project so that they could learn better cropping practices. A large number of household heads were married (58%) and a substantial percentage (35%) of widows was involved in the project. The high number of widows was explained by the fact that village heads and other traditional leaders encouraged widows to be considered first because they needed to support their families. So involvement in project activities would help vulnerable households, especially the female-headed households. Women are more engaged in farming activities in Goromonzi district especially in the production of legumes. Legumes are considered as women’s crops.

The mean age of farmers was 53 with a standard deviation of 12.76. This suggests that farmers become interested in farming as they grow older and the increasing experience of the farmers make them want to try out new technologies. There were varied differences in age around the mean as shown by the standard deviation. According to Okon and Enete (2009), farmers aged 27-55 years are the ones who engage more actively in agricultural activities and as such may want to try out new technologies. The mean age suggests that
most young farmers do not fully participate in agricultural activities. The older farmers are participating more in agricultural extension activities since most of them take their livelihood from farming. The younger people can opt to look for jobs elsewhere which might be more challenging for older farmers.

The mean household size was 5.07 persons per household and the mean number of people who could provide labour within the household was 3.18. Larger household sizes allow for better division of labour which enables the farmers to participate effectively in extension activities. During the rainy season when most trainings and meetings are conducted, labour is very critical because farmers are supposed to till their lands, rear cattle and do other household duties. As a result, participation in trainings and other extension activities can be limited by the number of members and those who are able to offer labour. The key informant interviews conducted showed that during the most critical stages of the season like planting and harvesting it was essential for lead farmers to call for trainings because all group members would be busy in their fields. Attendance of such meetings would favour those that had large pools of labour force as alluded to by Bogale and Shimelis (2009). Feder et al., (1985) showed that farmers are likely to participate in technologies that not labour intensive. The technologies brought by the N2Africa project were not labour intensive. They just required for the farmers to understand them and apply them in their fields for soil fertility improvement.

Sixty percent of farmers had attained secondary level education while three percent had never attended any school (Table 2). The high literacy level can possibly be explained by the fact that Goromonzi district is nearer to Harare (40-50 km) and is relatively well connected with tarred roads which facilitates easy access to schools. According to FAO (2013), people in Goromonzi value education very much, and this could also have
contributed to the high literacy levels although even in general literacy rates of Zimbabwean people are relatively high.

Most households (81%) take farming as their main occupation. Some farmers are engaged in regular non-farm wage employment (7%) and small-scale business (9%). The results show that all respondents owned arable lands but some of them did not use these lands as their main occupation, i.e. those doing regular non-farm wage employment, small scale business and petty trade. The reasons that were presented by those who relied on other sources for their livelihoods are that the land was not enough to produce sufficient food crops and cash crops for the families. Table 4 below shows that 16 out 18 respondents who indicated that farming was their main occupation had less than 2 ha arable land area. These farmers had to resort to additional sources to make a living.

**Table 4: Main occupation and land size**

<table>
<thead>
<tr>
<th>OCCUPATION</th>
<th>LAND SIZE (HA)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>less than 1</td>
</tr>
<tr>
<td>regular non-farm wage</td>
<td>19</td>
</tr>
<tr>
<td>employment</td>
<td></td>
</tr>
<tr>
<td>small scale business</td>
<td>2</td>
</tr>
<tr>
<td>Petty Trade</td>
<td>2</td>
</tr>
</tbody>
</table>

Data presented in Table 4 shows that 69% farmers owned arable land of less than 2 hectares. The mean land size for the farmers was 1.83 ha (Table 4) while the household with the minimum land size owned 0.4 ha and the household with the maximum land size owned 5 ha. The standard deviation for land size (0.97) shows that there were no huge variations in the size of land owned among the farmers. When asked whether the land was enough, 72% of the respondents said that the available land for cropping was not
enough while 28% indicated that it was enough. According to Chakona (2005), the land size in the communal areas of Goromonzi is a big issue because of people coming from Harare seeking land for residential purposes. Farmers indicated that their lands were becoming smaller due to increasing family sizes and people who illegally sell portions of their land to incomers from Harare. The continued and intensified use of the lands for cultivation increases the necessity to take sufficient soil fertility amendment measures in order to maintain sustainable yields.

In Table 3 the mean farming experience of the respondents was 19.56 with a standard deviation of 12.79. This suggests that most of the respondents have been farming for a long time and are now experienced. As put across by Okon and Enete (2009), farming experience has a positive relationship with the farmer’s desire to acquire new knowledge in farming. The more time farmers spend in the fields, the more they want to learn about new ways of farming that can increase their yields and better manage their natural resources, such as the soil. Mazvivavi et al. (2010) asserts that as the farmers gain experience with their environment and natural resources, they are more likely to get involved in trying new technologies. So the more farmers are engaged in farming, the more they want to gain knowledge about farming and learn about new technologies.

One farmer who was asked responded in this way, “We have been in this business for some years, some technologies have helped us to increase our yields and conserve our natural resources and some not. So we try out all new technologies that we are taught and see how they impact on our livelihoods.”
4.2 Effectiveness of the Lead Farmer Approach as Perceived by Follower Farmers

Follower farmers were asked to provide their perception on various services being offered by Lead Farmers during the implementation of the project. The results of follower farmers’ views on how effective the lead farmers were are presented in Table 5.

Table 5: Mean score of the effectiveness of the lead farmers

<table>
<thead>
<tr>
<th>Main Theme</th>
<th>Service</th>
<th>Mean</th>
<th>Std Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Meetings</td>
<td>Methods</td>
<td>3.56</td>
<td>0.95</td>
</tr>
<tr>
<td></td>
<td>Organising</td>
<td>3.52</td>
<td>1.1</td>
</tr>
<tr>
<td></td>
<td>StartEnd</td>
<td>3.46</td>
<td>0.91</td>
</tr>
<tr>
<td></td>
<td>Frequency</td>
<td>3.4</td>
<td>1.03</td>
</tr>
<tr>
<td></td>
<td>Regularity</td>
<td>3.5</td>
<td>1.07</td>
</tr>
<tr>
<td></td>
<td>Punctuality</td>
<td>3.47</td>
<td>1.08</td>
</tr>
<tr>
<td></td>
<td>Planning</td>
<td>3.55</td>
<td>0.97</td>
</tr>
<tr>
<td>2. Information Dissemination</td>
<td>Establishing</td>
<td>3.81</td>
<td>1.02</td>
</tr>
<tr>
<td></td>
<td>InviteFF</td>
<td>3.7</td>
<td>1.04</td>
</tr>
<tr>
<td></td>
<td>Protocols</td>
<td>3.46</td>
<td>1.12</td>
</tr>
<tr>
<td></td>
<td>Demonstrate</td>
<td>3.68</td>
<td>1.11</td>
</tr>
<tr>
<td></td>
<td>Interaction</td>
<td>3.62</td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td>SolveProbl</td>
<td>3.64</td>
<td>0.99</td>
</tr>
<tr>
<td></td>
<td>DiscussProb</td>
<td>3.72</td>
<td>0.93</td>
</tr>
<tr>
<td></td>
<td>Performance</td>
<td>3.69</td>
<td>1</td>
</tr>
<tr>
<td>3. Personal Characteristics</td>
<td>Altruism</td>
<td>3.52</td>
<td>1.1</td>
</tr>
<tr>
<td></td>
<td>Reliability</td>
<td>3.78</td>
<td>1.01</td>
</tr>
<tr>
<td></td>
<td>Patience</td>
<td>3.86</td>
<td>1.05</td>
</tr>
<tr>
<td></td>
<td>Commitment</td>
<td>3.86</td>
<td>0.95</td>
</tr>
</tbody>
</table>

A likert scale was used where 1 stands for very poor, 2 stands for poor, 3 stands for fair, 4 stands for good and 5 stands for very good.
The results in Table 5 above show that most of the responses given by the follower farmers were fair to good. For the purpose of clarity, a score of 3.5 and below will be considered as fair and a score above 3.5 will be considered as good. On meetings the lead farmers were considered to be good in the methods of meetings and organising the meetings (3.56 and 3.52 respectively). This may be attributed to the fact that most of the lead farmers felt honoured to be leaders among their peers and this motivated them to put an extra effort in their duties. Farmers have been involved in organising meetings for group marketing of horticultural produce in the district and as discussed in the focus group discussions. They meet very often on other agricultural activities like collective marketing of their produce to Harare.

Lead farmers were rated to be fair on the time to start and end meetings and the frequency of meetings (3.46 and 3.40 respectively). The follower farmers were asked to clarify on the ratings they had given to the lead farmers; whether the lead farmers took too much time on meetings or too little on meetings. The main points that came out are that the lead farmers took less time in the meetings and in most cases they would meet follower farmers less frequently. As explained by one follower farmer, lead farmers are also farmers and apart from taking the responsibility of training other farmers on soil fertility, they needed to attend to their own fields.

One of the criteria used in the selection of lead farmers was to choose farmers who were performing very well in their own fields, therefore it was important for them to maintain the same high standards of farming in their fields. The frequency and time of starting and ending meetings were reduced during periods when there were a lot of works in the fields. The lead farmers were concentrating more in their own fields and this would disrupt the frequency of meetings. The frequency of meetings were once a month during the start of
season and they would be reduced with the increase in workloads within the households. Follower farmers within one group were to discuss on how often they were to meet and come up with time schedules. The meetings also sometimes could not be conducted because some members of the groups would not turn up because of labour issues within their households.

On information dissemination, the LFA proved effective since most of the services were rated to be good. The results indicate that information dissemination was effective with a score of above 3.5. This suggests that lead farmers were able to go and train their follower farmers on the different technologies that they themselves had been trained on. Follower farmers were given a platform to discuss their own problems and share experiences among themselves. The lead farmers were also able to demonstrate technologies that they had learnt. The results show that explanation of protocols (mean score 3.46) was fair, suggesting that it might have been difficult for some lead farmers to provide full explanation of the technologies learnt, although they were able to practically demonstrate what they had been taught by extension.

The lead farmers were rated as effective in their personal characteristics, especially patience (3.86) and commitment (3.86). For the lead farmers to be well respected in their role, they had to show a level of commitment to what they were doing. It was imperative for the lead farmers to be patient with all follower farmers in their groups since this would earn them respect and make follower farmers listen to them.
4.3 Paired Samples T-tests: Effectiveness of the LFA in the increase in the knowledge of Farmers

Paired sample T-tests were used to compare the mean scores of the knowledge of respondents before and after the LFA. The main aim was to find if there was a significant difference in the level of knowledge of the respondents in all the subjects taught before and after engagement with Lead Farmers.

Table 6: Differences of means between the trainings (measurement of effectiveness of the LFA in knowledge increase)

<table>
<thead>
<tr>
<th>Paired Samples Test</th>
<th>Mean Before</th>
<th>Mean After</th>
<th>Difference between Means</th>
<th>Std. Deviation</th>
<th>t-Statistics</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Agronomy</td>
<td>2.98</td>
<td>4.43</td>
<td>1.45</td>
<td>0.809</td>
<td>17.929</td>
<td>0.000</td>
</tr>
<tr>
<td>Specific legume agronomy</td>
<td>2.02</td>
<td>4.69</td>
<td>2.17</td>
<td>0.911</td>
<td>23.828</td>
<td>0.000</td>
</tr>
<tr>
<td>Intercropping and Rotations</td>
<td>1.78</td>
<td>4.02</td>
<td>2.24</td>
<td>1.055</td>
<td>21.227</td>
<td>0.000</td>
</tr>
<tr>
<td>BNF</td>
<td>1.33</td>
<td>3.89</td>
<td>2.56</td>
<td>1.166</td>
<td>21.952</td>
<td>0.000</td>
</tr>
<tr>
<td>Knowledge of nodules</td>
<td>1.17</td>
<td>3.71</td>
<td>2.54</td>
<td>1.193</td>
<td>21.296</td>
<td>0.000</td>
</tr>
<tr>
<td>Identification of effective and ineffective nodules</td>
<td>1.14</td>
<td>3.07</td>
<td>1.93</td>
<td>1.423</td>
<td>13.561</td>
<td>0.000</td>
</tr>
<tr>
<td>Theory of Inoculation</td>
<td>1.01</td>
<td>3.24</td>
<td>2.23</td>
<td>1.213</td>
<td>18.381</td>
<td>0.000</td>
</tr>
<tr>
<td>Inoculation Practical</td>
<td>1.01</td>
<td>2.88</td>
<td>1.87</td>
<td>1.412</td>
<td>13.246</td>
<td>0.000</td>
</tr>
</tbody>
</table>

P-value at 1% level of significance

From the results (Table 6), it can be observed that the LFA was effective in the increase in knowledge of the follower farmers (p<0.001). The increase in knowledge among the follower farmers was varied as shown by the standard deviations (13.246 – 23.8289). On general agronomy, across all the 100 respondents, the mean score before that training was
2.98 and the mean score after the trainings was 4.43 with difference of 1.45 between the means. The standard deviation was 0.809 and the T-statistics was 17.929. The P-value shows that there was significant increase in the knowledge of the farmers because of the trainings conducted. The lowest mean scores before were recorded on theory of inoculation and inoculation practical (1.01) meaning that the level of knowledge of the follower farmers was very poor before the trainings. The highest mean scores before the approach were recorded on specific legume agronomy (2.02) and general agronomy (2.98).

The standard deviation for the before- and after- measurements reveal that most variability was encountered in the identification of effective and ineffective nodules and the practical on inoculation. Subjects experienced less variability in general agronomy and specific legume agronomy.

Overall, the results show that the increase in knowledge was not due to change but it was because of the LFA that was implemented by the N2Africa project.

4.4 Linear Regression: Factors that contribute to increase in Knowledge of the Follower Farmers

4.4.1 Conceptual / Empirical Framework

The Linear regression that was performed to determine the socio-economic factors that affect the effectiveness of the LFA.

\[ Y_1 = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + \ldots \ldots + B_nX_n + e \]  

(1)

\( Y_1 \) is the dependent variable.
In this study, the effectiveness of the LFA was measured by the increase in knowledge of the follower farmers. The $X_i$s are independent variables. The choice of the independent variables was guided by empirical literature and study context. The first thing that was done was to compute the change in the follower farmers’ increase knowledge on the different soil fertility technologies that were taught. The change in knowledge was obtained by the subtracting the mean knowledge score before and after the training for each subject taught. This was done to obtain the change index in the knowledge of the farmers for each subject taught. The total change index was obtained by summing all change indexes for the subject taught. The minimum score for each subject was 1 and the maximum score was 5. So the minimum score index to be obtained would be 1 and the maximum score index would be 4 (score after – score before). A score index of 1 would mean that the respondent would not have gained any knowledge from the trainings whilst a score of 4 would mean that the respondent would have maximum increase in the knowledge. So the dependent variable was now the change index in the level of knowledge.

The independent variables were the socio-economic characteristics of the FF as indicated in section 4.1 above.
Table 7: Factors affecting the increase in the knowledge of the follower farmers

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>T-Statistic</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>3.519</td>
<td>2.297</td>
<td>0.024</td>
<td></td>
</tr>
<tr>
<td>Sex of Household Head</td>
<td>0.01</td>
<td>1.164</td>
<td>0.077</td>
<td>0.939</td>
</tr>
<tr>
<td>Farming Experience</td>
<td>0.04</td>
<td>0.046</td>
<td>0.445</td>
<td>0.657</td>
</tr>
<tr>
<td>Land Size</td>
<td>-0.20</td>
<td>0.589</td>
<td>-2.086</td>
<td>0.04**</td>
</tr>
<tr>
<td>Methods of conducting group meetings</td>
<td>0.45</td>
<td>0.892</td>
<td>3.216</td>
<td>0.002**</td>
</tr>
<tr>
<td>General performance in Technology Dissemination</td>
<td>0.16</td>
<td>0.884</td>
<td>1.062</td>
<td>0.291</td>
</tr>
<tr>
<td>Age of Household head</td>
<td>0.01</td>
<td>0.046</td>
<td>0.061</td>
<td>0.951</td>
</tr>
<tr>
<td>Main occupation of the household head</td>
<td>-0.08</td>
<td>0.755</td>
<td>-0.848</td>
<td>0.399</td>
</tr>
<tr>
<td>Marital status of the household head</td>
<td>-1.73</td>
<td>0.90</td>
<td>-1.927</td>
<td>0.057</td>
</tr>
<tr>
<td>Number of Ploughs owned</td>
<td>0.00</td>
<td>1.607</td>
<td>0.023</td>
<td>0.982</td>
</tr>
<tr>
<td>Number of Draft cattle owned</td>
<td>-0.09</td>
<td>1.489</td>
<td>-0.731</td>
<td>0.466</td>
</tr>
<tr>
<td>Number of Radios owned</td>
<td>-0.09</td>
<td>1.099</td>
<td>-1.006</td>
<td>0.317</td>
</tr>
</tbody>
</table>

**= 5% level of significance, ***=1% level of significance

There is a negative correlation between the land size of the follower farmers and increase in knowledge \( (p<0.05) \) (Table 7. The more land farmers have, the less they are likely to participate in soil technology issues. Farmers with less land were more interested in the disseminated agricultural technologies and were also paying more attention in the trainings thereby resulting in increased knowledge. Farm size was mentioned by Parvan (2013) as one of the most important characteristics that influence farmers to engage in and adopt new technologies. However, he also argues that some agricultural technologies need a certain amount of land in order to be well implemented (Parvan, 2013). Several studies conducted showed that farmers with large pieces of land were the ones who could participate in agricultural technologies and eventually adopt these technologies (e.g.
Robertson et al., 2012, Walton et al., 2008, Moser and Barrett, 2003). The reason given was that farmers with large pieces of land can afford to experiment with new technologies. Feder et al. (1985) also asserts that households with larger farm sizes tend to get involved in new technologies more than households with small sized lands. On the contrary, in the LFA, the technologies were aiming at soil fertility improvement and the farmers with smaller sized farms tended to be much involved in the project so that they could learn new ways of keeping their soil fertile.

Results show that there is a positive correlation between the methods of conducting meetings and increase in knowledge ($p<0.01$). The way meetings were conducted contributed to increase in knowledge of the follower farmers. This shows that Lead Farmers who were more effective in conducting group meetings taught their follower farmers very well and this resulted in increased knowledge of the follower farmers.
CHAPTER FIVE

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of Findings and Conclusions

From the study, it has become clear that more women were participating in agricultural activities in Goromonzi district than men. The results also show that female farmers are participating more in agricultural extension since they are the ones who do most of the agricultural work. As alluded to by Doss and Morris (2001), men and women have different preferences when it comes to technology adoption. The agricultural activities in Goromonzi district also enhance more participation of female farmers in agricultural extension. Many farmers in Goromonzi district practice horticultural gardening and they sell the horticultural produce in Harare. This has encouraged the farmers to work as groups and participate in soil fertility technologies dissemination under the LFA. The high numbers of widows was explained by traditional leaders as an encouragement for female-headed households to be involved in agricultural projects so that they can fend for their families.

Most of the farmers in Goromonzi have arable land sizes that are less than 2 ha. This is a huge challenge since for most households farming is their main occupation and source of livelihood. With increased household sizes and migration of people from Harare looking for residential stands, the landholdings are getting smaller and smaller. The soils have also been used intensively and soil fertility is declining.
The lead farmer approach was rated as fairly effective on frequency meetings, time to start and end meetings (3.4 and 3.46 respectively). The increased workloads of farmers during the season meant that they were concentrating more on their field work and could not effectively meet their group members for meetings or trainings. The Follower Farmers rated personal characteristics of Lead Farmers as contributing more to the effectiveness of the Lead Farmers. This may be attributed to the fact that lead farmers felt honoured to be part of extension and they were carrying their assignment with pride.

The T-tests that were run to determine the increase in the level of knowledge of follower farmers indicated that all follower farmers showed a significant level of increased knowledge after they had been trained, which statistically (p<0.001) proved that this was due to the trainings which were conducted by the lead farmers.

A linear regression which was run to determine factors that contribute to the increased level of knowledge and effectiveness of the LFA approach showed that there was a significantly negative correlation between land size and the change in knowledge. This showed that farmers with smaller land sizes were more focussed on maximizing productivity by learning about soil fertility technologies. There was a significant positive correlation between methods of conducting group meetings and an increase in knowledge (p<0.05). If farmer groups are organized around and trained by their peer leaders, they will understand new concepts and technologies better.

5.2 Recommendations

From the study, it was observed that women were participating more in the extension of soil fertility technologies. With the increase in family sizes and in-migration of people from Harare, the women farmers were willing to learn more about soil fertility and
improve their productivity on the pieces of land they had. It is therefore recommended that women should be empowered more to participate in agricultural extension since they are the ones who always till the land when their male counterparts are either in towns looking for employment or undertaking other activities.

The study proofed that the LFA has been an effective extension approach which led to an increased level of knowledge among farmers. This could be attributed to the level of education of the follower farmers, participation of women in extension services, availability of labour among participating households, and the methods of trainings conducted by the Lead Farmers.

It is therefore recommended that the LFA can be used by governments and NGOs since it empowers farmers to be active participants in technology dissemination. Additionally, it is a relatively cheap extension model. With the financial challenges being faced by public extension agents and NGOs, the LFA can be an alternative way to reach more farmers with extension technologies.

The LFA was conducted in Goromonzi district, which is Natural IIA, and very near the capital city. For further studies of this nature, it would be ideal to carry out the research in districts that are far away from main city centres and which receive less rainfall so as to get some varied representation of the responses.

For the approach to be more effective and sustainable, lead farmers need to be motivated and up to date with current knowledge. An important option that was not covered in this study is to help farmers to organise themselves into rural enterprise groups and form more formal groupings. This will improve their confidence, performance and also support them
to get access to services that will enable them to offer greater help to their Follower Farmers.

Further studies should look the socio-economic characteristics of Lead Farmers and determine which characteristics may result in a Lead Farmer Approach being even more effective.
REFERENCES


Gwarazimba. V., (2011) Strategies for resuscitating Zimbabwe’s Agriculture. Entrepreneurship Africa


Appendix 1: Evaluation of Lead Farmer approach: Lead Farmer Questionnaire

Table 1: Identification Information

<table>
<thead>
<tr>
<th>Row</th>
<th>Variable</th>
<th>Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Questionnaire No</td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>Date of interview</td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td>Name of enumerator:</td>
<td></td>
</tr>
<tr>
<td>1.4</td>
<td>Province</td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td>District</td>
<td></td>
</tr>
<tr>
<td>1.6</td>
<td>Group village head</td>
<td></td>
</tr>
<tr>
<td>1.7</td>
<td>Village</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Household Demographic information

<table>
<thead>
<tr>
<th>Row</th>
<th>Household characteristic</th>
<th>Response codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Name of respondent:</td>
<td></td>
</tr>
<tr>
<td>2.2</td>
<td>Is respondent household head?</td>
<td>1=yes, 0=no</td>
</tr>
<tr>
<td>2.3</td>
<td>If no, relationship of respondent to household head</td>
<td>1=spouse 2=child 3=other, specify</td>
</tr>
<tr>
<td>2.4</td>
<td>Name of household head:</td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>Sex of household head</td>
<td>1=Male 0=female</td>
</tr>
<tr>
<td>2.6</td>
<td>Age of household head in years</td>
<td></td>
</tr>
<tr>
<td>2.7</td>
<td>Highest level of education of Household head</td>
<td>0=no education 1=primary 2=secondary 3=university 4=vocational 5=other</td>
</tr>
<tr>
<td>2.8</td>
<td>Marital status of household head</td>
<td>1=single 2=married 3=divorced 4=widowed</td>
</tr>
<tr>
<td>2.9</td>
<td>Main occupation of household head</td>
<td>1=farming;</td>
</tr>
</tbody>
</table>
Table 3: Understanding of project issues

Use the 5 point Likert scale to rank your understanding of N2Africa legume cultivation before and during project issues 1= very poor 2=poor 3=fair 4=good 5= very good

<table>
<thead>
<tr>
<th>Row</th>
<th>Before project (score)</th>
<th>Now (score)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>General agronomy</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Specific legume agronomy</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Intercropping and rotation strategies</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Biological Nitrogen Fixation</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Knowledge on nodules</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Identifying effective and ineffective nodules</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Inoculation (theory)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Inoculation (practical)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Pest and disease identification</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Treatment of pests and diseases</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Post-harvest handling and Storage</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Intercropping and crop rotation</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Value addition/Food Processing</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Nutrition aspects of legumes</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>The N2Africa Project and its Objectives</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Farming as a business</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Collective marketing</td>
<td></td>
</tr>
</tbody>
</table>
### Table 4: Effectiveness of lead farmers

How do you rank the effectiveness of the lead farmer in the following areas? Use the following scores in your ranking: 1 = very poor; 2= poor; 3=fair; 4=good; 5=very good

<table>
<thead>
<tr>
<th>Row</th>
<th>Trait</th>
<th>score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Regularity of visits to follower farmers</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Establish a demonstration plot</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Inviting follower farmers to visit demo plot</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Organize meetings</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Explaining procedures/protocols (inoculation, demo layout)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Ability to demonstrate technologies learnt (explain clearly what is on the demo plots)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Interaction with farmers</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Methods of conducting group meetings</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Careful planning of cultivation activities (planting, field days, visits to follower farmers)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Ability to solve farmers’ problems in legume cultivation</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Starting and ending meetings in time at agreed time</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Allowing farmers to discuss problems and challenges facing them</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>General performance in the dissemination of technologies</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Ability to keep visit schedule</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Patience of the lead farmer</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Punctuality in attending meetings and demonstrations related to legume cultivation from Agritex, NGOs and others.</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Reliability</td>
<td></td>
</tr>
</tbody>
</table>

### Table 5: Trainees’ Views of how well the LF taught various topics

Use the Likert scale (1 = very poor; 2= poor; 3=fair; 4=good; 5=very good) to rank how well the Lead Farmer trained follower farmers on the following issues.

<table>
<thead>
<tr>
<th>Row</th>
<th>Score</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>General agronomy</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Specific legume agronomy</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Intercropping and rotation strategies</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Biological Nitrogen Fixation</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Knowledge on nodules</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Identifying effective and ineffective nodules</td>
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</tr>
<tr>
<td>7</td>
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<td>Treatment of pests and diseases</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Post-harvest handling and Storage</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Intercropping and crop rotation</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Value addition/ Food Processing</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Nutrition aspects of legumes</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>The N2Africa Project and its Objectives</td>
<td></td>
</tr>
</tbody>
</table>
Table 6: Ranking the most important subjects taught by lead farmer

Using a scale of 1-5, rank the five most important subjects that you have received training on from the Lead farmer; (1-most important, 5-least important)

<table>
<thead>
<tr>
<th>Row</th>
<th>Topic</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>General and specific legume agronomy</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Inoculation (theory) and practical</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Biological Nitrogen Fixation and Identification of effective and ineffective nodules</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Pest and Disease identification and control</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Value addition and Nutritional aspects of legumes</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Farming as a business</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Collective marketing</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Post- harvest handling and Storage</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Other (1) Specify</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Other (2) Specify</td>
<td></td>
</tr>
</tbody>
</table>

Table 7: Ownership of agricultural equipment

<table>
<thead>
<tr>
<th>Row</th>
<th>Agricultural enterprise equipment</th>
<th>7.2. Does your household own? 1=yes, 0=no</th>
<th>7.3. Number owned</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hoes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Plough</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Draft cattle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Draft donkeys</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Tractor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Wheelbarrow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Sprayer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Planter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Ox cart</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Hand cart</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Bicycle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Car</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Truck</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Motorbike</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Non-agricultural enterprise equipment

<table>
<thead>
<tr>
<th>Row</th>
<th>Communication equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Hand cart</td>
</tr>
<tr>
<td>11</td>
<td>Bicycle</td>
</tr>
<tr>
<td>12</td>
<td>Car</td>
</tr>
<tr>
<td>13</td>
<td>Truck</td>
</tr>
<tr>
<td>14</td>
<td>Motorbike</td>
</tr>
<tr>
<td>Row</td>
<td>Type of Livestock</td>
</tr>
<tr>
<td>-----</td>
<td>------------------</td>
</tr>
<tr>
<td>1</td>
<td>Cattle</td>
</tr>
<tr>
<td>2</td>
<td>Goats</td>
</tr>
<tr>
<td>3</td>
<td>Sheep</td>
</tr>
<tr>
<td>4</td>
<td>Pigs</td>
</tr>
<tr>
<td>5</td>
<td>Donkeys</td>
</tr>
<tr>
<td>6</td>
<td>Chickens</td>
</tr>
</tbody>
</table>
Appendix 2: Focus Group Questions

1. **How many meetings were held per month/fortnight/week?**
   *This information helps to assess the frequency on which groups carry out their activities and whether the time frame is sufficient enough for the activities.*
   
   - Was the time period/frequency adequate/effective?
   - What were the agendas of the meetings, did they meet the project objectives?

2. **How were the trainings carried?**
   *This will aid in assessing what are the important subjects of follower farmers. Also this will help in understanding of how they follower farmers rate the different technologies they were taught.*

   **Additional guiding questions:**
   
   - How did the trainings impact in terms of knowledge dissemination?
   - **What were you taught?**
   - How do you perceive the trainings in terms of their content and usefulness in your agricultural activities?
   - What is the **most important** thing that you **learnt** from your lead farmer?
   - What are the best methods of training that were employed during the trainings?

3. **What is the distance of the farmer who is farthest from the meeting point?**
   *The purpose is to check whether distance has an impact on group function.*

   **Additional guiding questions:**
   
   - How did this affect in the participation farmers in the group?

4. **In your own view, is the group effective?**
   *The objective is to get the group’s opinion on the usefulness. It is important since this aid in farmers spell out what they mean when they say the group is effective or is not.*

   **Additional guiding questions:**
   
   - If yes, why do you say so? If No can give reasons why you think that the group is not effective?
   - What do think needs to be done for the group to be effective?
   - What are the main weaknesses of the lead farmer approach?
   - What are the main strength of the lead farmer approach? (group size, age differences, gender, distances apart).
   - What would be the ideal group size?
5. How do you compare your group to other N2Africa groups nearer to you?  
*By comparing with other groups nearby, the groups can judge themselves whether they are doing well or not and in what sense are they doing well.*

**Additional guiding questions:**

- Do you think your group is better than others or vice versa and why do you say so?

6. In your own view what are the **positive and negative effects** of the Lead Farmers approach?  
*This will bring about the opinions of the farmers on the lead farmer approach whether it can be used in agricultural technology dissemination or not.*