

**DISSEMINATION PATHWAYS FOR AGROFORESTRY TECHNOLOGIES:
THE CASE FOR IMPROVED FALLOWS IN EASTERN ZAMBIA**

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DECLARATION

I, the undersigned, hereby declare that the work contained in this thesis is my own original work and that I have not previously in its entirety or in part submitted it at any University for a degree

Signature

Date

ABSTRACT

Agroforestry researchers in Eastern Zambia have identified improved fallows as an intervention for soil fertility problems faced by small-scale farmers. In both on-station and on-farm research experiments which have been conducted since 1989, results have shown that improved fallows can mitigate soil degradation and eventually improve land productivity. Both researchers and extensionists have since embarked on disseminating these fallows to the farming community. Researchers were initially entirely dependent on the conventional agricultural extension services to disseminate the technology to the farmers but the process was slow and so was the uptake for the technology by farmers. As researchers were anxious to see that farmers took up improved fallows in a fastest possible way, they opted to use alternative dissemination pathways such as farmer trainers and local leaders.

The purpose of this study was to investigate the three dissemination pathways and determine their effectiveness as regards improved fallows. This study assumed that farmers were not taking up improved fallows because they lacked knowledge of it, and also that the lack of knowledge was exacerbated by the ineffective pathway used to reach the farmers.

The study was conducted in Chadiza, Chipata and Katete districts of Eastern Zambia. Data were collected using questionnaires in 28 villages across the three districts. Included in the sample were 296 small-scale farmers for whom this technology is intended. Additionally, 51 farmer trainers, 15 local leaders and 14 agricultural extension officers were interviewed as disseminators of this technology. Farmers were randomly sampled; local leaders were systematically sampled while a total enumeration was done for farmer trainers and agricultural extension officers present at the time of the interviews.

This study found that 92% of the farmers were aware of the technology, with 68% having only known about it between 1998 and early 2000. This was the period when farmer trainers were already working. Farmer trainers were source of initial information to 41% of the farmers and yet they only started working recently. Although 92% of the farmers had heard about improved fallows, only 33% had ever planted some. Ten percent of the entire population of farmers could be said to have adopted improved fallows because they have planted more than one fallow. Lack of knowledge is therefore not the only reason that farmers were not taking up improved fallows.

Farmer trainers were found to currently be a more effective dissemination pathway as they were able to reach more farmers even in areas where agricultural extension officers had not been before. Local leaders have not been involved with disseminating improved fallows. Agricultural extension officers were hampered by lack of resources but were still trying to assist farmers with resource assistance from external institutions such as NGOs. The findings point to a need for participatory extension approaches as well as participatory monitoring and evaluation systems.

OPSOMMING

Agrobosbou-navorsers in Oos-Zambië het braaklandbewerking geïdentifiseer as ingryping in grondvrugbaarheidsprobleme wat ondervind word deur boere wat op klein skaal boer. Die resultaat van eksperimente wat gedoen is as deel van beide proefplaas- en plaasnavorsing sedert 1989 het daarop gewys dat die bewerking van braaklande die agteruitgang van grond kan temper en geleidelik die produktiwiteit daarvan kan verhoog. Navorsers sowel as voorligtingsbeamptes het sedertdien onderneem om braaklandbewerking aan die boeregemeenskap bekend te stel. Navorsers was aanvanklik ten volle afhanklik van die konvensionele landbou-voorligtingsdienste om die verspreiding van tegnologiese kennis onder boere te hanteer. Hierdie verspreidingsproses was egter stadig en die boere het ook te lank geneem om die tegnologie in werking te stel. Aangesien dit vir die navorsers belangrik was dat boere braaklandbewerking so spoedig moontlik begin, het hulle daarop besluit om alternatiewe metodes van kennisverspreiding te gebruik. Hierdie alternatiewe metodes het behels dat inligting versprei is deur opleidingsbeamptes onder boere sowel as deur plaaslike leiers.

Die doel van hierdie studie was om die drie kanale wat gebruik is om inligting te versprei, te ondersoek en die effektiwiteit daarvan vas te stel. Hierdie studie het voorveronderstel dat boere nie braaklandbewerking gebruik nie omdat hulle nie oor die nodige kennis beskik het nie, en dat die gebrek aan die nodige kennis veroorsaak en vererger is deur die oneffektiewe kanale wat gebruik is om die inligting onder boere te versprei.

Die studie is uitgevoer in die distrikte Chadiza, Chipata en Katete van Oos-Zambië. Data is ingesamel deur die gebruik van vraelyste in 28 dorpe dwarsdeur die drie distrikte. Dié steekproef sluit 296 boere in wat op klein skaal boer en op wie dié tegnologie gemik was. Onderhoude is gevoer met 'n aantal addisionele persone, as verspreiders van tegnologiese kennis, bestaande uit 51 opleidingsbeamptes onder boere, 15 tradisionele plaaslike leiers, en 14 landbou-voorligtingsbeamptes. Boere is lukraak getrek vir die steekproef. Plaaslike leiers is sistematies getrek, terwyl die totale aantal opleidingsbeamptes en landbou-voorligtingsbeamptes wat teenwoordig was ten tye van die onderhoude, as proefpersone gebruik is.

Daar is bevind dat 92% van die boere bewus was van dié tegnologie, waarvan 68% eers tussen 1998 en vroeg 2000 daarvan gehoor het. Dit was die periode waarin opleidingsbeamptes alreeds onder die boere werksaam was. Opleidingsbeamptes was vir 41% van die boere die bron van die oorspronklike inligting, en tog het hulle onlangs eers onder die boere begin werk. Alhoewel 92% van die boere al van die bewerking van braaklande gehoor het, het slegs 33% al ooit braaklande aangelê. Daar kan gesê word dat tien persent van die totale boerebevolking braaklandbewerking prakties toegepas het omdat hulle meer as een bewerkte braakland aangelê het. Die gebrek aan kennis is daarom nie die enigste rede vir boere se traagheid om die praktyk van braaklandbewerking te aanvaar nie.

Opleidingsbeamptes blyk tans die mees effektiewe verspreiders van inligting onder boere te wees aangesien hulle daartoe in staat was om meer boere te bereik, selfs in gebiede waar landbou-voorligtingsbeamptes nog nooit voorheen was nie. Plaaslike leiers was nie betrokke by die verspreiding van braaklandbewerking nie. Landbou-

voorligtingsbeamptes is gekniehalter deur 'n gebrek aan hulpbronne, maar het steeds probeer om boere by te staan met behulp van bystand wat verleen is deur eksterne instellings soos Nie-Regeringsorganisasies (NRO's). Dié bevindinge dui op 'n behoefte aan voorligtingsbenaderings sowel as monitering- en evalueringstelsels wat deelname-geöriënteer is.

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ACRONYMS

AWDA	Area Women Development Association
CSO	Central Statistics Office
DACO	District Agricultural Co-ordinator
D&D	Diagnostic and Design
DWDA	District Women Development Association
EEOA	Economic Expansion in Outlying Areas
ICRAF	International Centre for Research in Agro-Forestry
KEPA	Service Centre for Development Co-operation (KEhitysyhteistyön PALvelukeskus)
LWF	Lutheran World Federation
MAFF	Ministry of Agriculture, Food and Fisheries
NGO	Non-Governmental Organisation
PEA	Participatory Extension Approach
RCZ	Reformed Church of Zambia
SAP	Structural adjustment programme
T&V	Training and Visit
WVI	World Vision International
WV-IAP	World Vision-Integrated Agroforestry Project

1. INTRODUCTION

Agroforestry refers to “*a dynamic, ecologically based natural resources management system that, through the integration of trees in farmland and range land, diversifies and sustains production for the increased social, economic and environmental benefits for land users at all levels*” (Huxley and van Houten, 1997). It is an old art, which has been practised by people all over the world for centuries (Nair, 1993; Steppler and Nair, 1987). It has however recently received scientific attention. Scientific attention has increasingly focused on agroforestry because of its potential to solve many problems related to the productivity and sustainability of agriculture (Kamara *et al.*, 1993). Agroforestry is a useful tool to overcome some of the world’s major concerns: rural poverty, natural resource conservation and sustainable development (Maghembe *et al.*, 1992). These concerns arose from population pressure, which increased the need to produce more food and fuel-wood.

A focus on agroforestry science in the early 1970’s saw the establishment of the International Centre for Research in Agroforestry (ICRAF) in 1977. ICRAF institutionalised an old practice for the first time (Steppler and Nair, 1987). Since then, much has taken place in terms of research development, documentation and extension of agroforestry. In Africa for example, ICRAF has divided the continent into agro-ecological regions so that each regional office co-ordinates programs that are best suited to the area (Maghembe *et al.*, 1992). The main land-use system in the Southern African region is small-scale farming. Crop production relies on one growing season, from December to April, with a long dry season the rest of the year.

Research undertaken by ICRAF is normally preceded by Diagnosis-and-Design (D&D) studies (Ngugi, 1988). These studies have revealed two major land-use problems that affect farmers across the region as: declining soil fertility and dry season shortage of livestock fodder. Research was then designed to develop agroforestry interventions to address these problems.

The overall objective of agroforestry research is to establish interventions that would help combat problems of decreased agricultural productivity and environmental degradation. So far, the results from both on-station and on-farm trials of improved fallows have given positive results, but unless farmers adopt them, these research findings are of no use (van den Ban and Hawkins, 1988).

The success of any new agricultural technology is judged ultimately by its adoption and acceptance by farmers and consumers, and the positive changes it brings about at household, local, national and regional level (Soniia, 1997). The application of new agricultural technology should improve combinations of efficiency, equity, sustainability and risk in producing desired outputs (Garforth and Usher, 1997). Therefore, to make judgement of the usefulness of the agroforestry interventions, farmers need to adopt them.

There are however many factors that influence farmers' decisions to or not to take up a new technology (Franzel, 1999), dissemination being one of them. In some areas of southern Africa, farmers have not adopted technology that has been available for sometime partly because of poor extension (Rwelamira and Kleynhans, 1998). Thus, dissemination problems can reduce the adoption and impact of even the most acceptable new technology (Soniia, 1997).

Dissemination constitutes a recognised weak point in the technology development process in most of sub-Saharan Africa. Farmers attempt to use various communication channels to acquire information, to increase knowledge, and to support their own decisions. Most of this communication takes place through non-formal means. However, appropriate strategies and procedures are required for speedy diffusion of innovations, and communication of such information remains the subject of research (Soniia, 1997).

1.1. Problem statement

One of the problems faced by the smallholder agricultural sector in southern Africa is the declining productivity of soils. Declining soil fertility is caused by such factors as soil

erosion and degradation, little or no use of manure and/or fertiliser in continuous cropping systems and the erratic rainfall (Kwesiga *et. al.*, 1997). With most soils being deficient in plant nutrients, especially nitrogen and phosphorus, good yields of maize cannot be obtained without use of fertilisers. In the light of the declining agricultural production associated with declining soil fertility, research in agroforestry is being undertaken in most African countries to find ways of improving the soil, and hence crop production. It is important to find alternative technologies that would assist farmers to improve production without incurring high costs.

In eastern Zambia, a diagnostic and design survey identified low crop yield as a major problem facing farmers in the districts of Chipata and Katete (Ngugi, 1988). This problem, though largely attributed to the low status of the soil, is exacerbated by increased population pressure (Kwesiga and Coe, 1994). The increased population destabilises traditional fallow periods due to a shortage of agricultural land. The present short duration weed or grass fallows of 1-5 years are inadequate to restore soil fertility, and the cost of fertilisers that farmers need to reverse the trend is too high (Kwesiga *et. al.*, 1997).

Farmers attempt to overcome the fertility problem through the use of many techniques which include the application of fertilisers, practising crop rotation, fallowing or intercropping grain with legumes such as groundnuts and beans, and/or use of organic manure (Kwesiga and Coe, 1994; Mwiinga *et. al.*, 1994). With the use of chemical fertilisers, farmers are able to achieve high productivity but this method is costly to small-scale farmers due to high fertiliser market prices. *“Farmers who can neither afford nor rely on a supply of inorganic fertilisers must find alternative sources of nutrients. These sources are often cheaper, more efficient than inorganic compounds and focus on recycling of nutrients”* (Pretty, 1995:113). Although cheaper, other techniques such as the use of organic fertilisers or green manure are rare because they have high labour demands. The use of cattle manure is common among those that own the animals.

Previously, the government in Zambia intervened to ensure self-sufficiency of maize production by subsidising fertiliser prices, and supplying hybrid maize seed and fertilisers

on credit. It has since been realised that regulation and control of agricultural production, marketing and pricing coupled with heavy subsidies are unsustainable and discouraging to agricultural development. Fertiliser prices have continued to rise since the removal of subsidies (Mwiinga *et al.*, 1994) and yet the hybrid maize that farmers are planting is very demanding of nutrients. It therefore became necessary to find alternative technologies that could improve crop productivity with low input costs.

Eastern Zambia is one of ICRAF's sites in southern Africa where research on alternative technologies to replenish nitrogen in the soil is being undertaken. Nitrogen has been identified as the most limiting factor for agricultural production. An estimated 120-200 kg N ha⁻¹ yr⁻¹ is required for an economic yield of hybrid maize, an amount that is not naturally available in the soil for plant growth (Kwesiga *et al.*, 1997).

Over the last decade, improved fallows have been developed as a means to combat problems of decreasing agricultural productivity and environmental degradation. Improved fallows refer to a system whereby trees are planted on a piece of land during the fallow instead of just leaving it idle. They are believed to have great potential for improving soil fertility in areas affected by nitrogen deficiency (Kwesiga and Coe, 1994). By providing nitrogen to crops, tree fallows can help farmers increase their incomes and help the nation to improve its food security (Franzel, 1999).

In Zambia, both on-station and on-farm studies have shown that improved fallows of 2-3 years of *Sesbania sesban*, a nitrogen-fixing legume, can increase maize yields significantly. Using a variety of nitrogen fixing tree species in improved fallow systems, maize yields following a 2-year improved fallow were found to approach those of fully fertilised fields (Kwesiga and Beneist, 1998). For example, in Chipata, Zambia, farmer-managed trials following a 2-year *Sesbania sesban* fallow increased production from 0.3 to 1.3 t ha⁻¹ in continuously cropped maize to 2.3 to 4.8 t ha⁻¹ following an improved fallow (Kwesiga *et al.*, 1999).

Improved fallows with leguminous trees have provided a promising alternative for the farmers. The fast growth of leguminous fallow species makes them contribute to soil

fertility more quickly than natural vegetation (Opio, 1994; van Gelder and O'Keefe, 1995) and therefore eliminates or at least drastically reduces the need for long fallow periods to restore natural fertility. With improved soil fertility, there would be increased food production and hence reduction in poverty.

With such encouraging results from research studies, it becomes desirable to transfer this technology to the intended beneficiary. The fact that even on-farm research results have been positive gives an indication of the performance of improved fallows on an ordinary farm.

1.2. Rationale

Agroforestry research findings, such as those from experimental improved fallows, need to be taken up by many farmers for them to have an impact on rural poverty. The improved fallow technology therefore requires to be successfully disseminated to farmers to make them aware of its existence and benefits.

Current extension services are operating without adequate linkage with research institutions (Maddock and Wilson, 1994). The research breakthroughs that these institutions are able to develop are not readily incorporated into the farming systems because of lack of farmer participation in their development (Pretty, 1995). For 10 years now, research has been underway at ICRAF in Chipata to identify improved fallow techniques that could address the farmers' critical land productivity needs (Kwesiga *et al.*, 1997). However, there has been inadequate diffusion of these technologies to the farmer. Diffusion of technology between research stations and the farmer is currently being curtailed by the absence of a strong link between the two. The unfavourable structures and lack of financial resources, skills and motivation of the extension personnel often weaken the agricultural extension institution (Hedden-Dunkhorst and Mollel, 1999). Concerted efforts need to be placed in effectively administering the diffusion of appropriate technologies for improved crop production, food security, soil, and water conservation.

The role of women in food production and processing is critical. They are farmers in their own right, partners with men on household level and are also the main cultivators of gardens (Saito and Weidenmann, 1990). Despite their multiple roles in their households, existing agricultural extension processes have usually excluded them, and been directed at men. Both the percentages of women employed in the agricultural sector and those being reached by extension services are lower than for men (Saito and Weidenmann 1990; van Crowder, 1998). In Zambia, only five percent of the extension staff are women (Mitti *et al.*, 1997).

The country as a whole puts emphasis on agricultural production for raw materials and for food (Chipopola, 1994). Previously, Zambia depended on copper and people left their home areas to work on the mines to support their families' back home. Now the mines are no longer employing masses of people and yet the population in the country is ever increasing. The government can no longer depend on copper alone for development. Therefore, the Department of Agriculture is putting emphasis on agricultural extension to diversify from copper (Chipopola, 1994). Increased production leading to development can only be achieved if farmers adopted technical innovations, such as improved fallows.

In an attempt to reach more farmers, ICRAF, in collaboration with development partners, has been involved in disseminating agroforestry technology in southern Africa (ICRAF, 1998). ICRAF works with a range of government research and extension services, and non-governmental organisations (NGOs) to ensure wide dissemination of the improved fallow technology (ICRAF, 1999). In eastern Zambia, dissemination of improved fallows officially started in 1995 when type 3 on-farm trials were established (ICRAF, 1998). It is hoped that the continued collaboration between ICRAF and these organisations will enhance efforts to reach out to millions of farmers.

Three pathways have been used to try to reach the farmers. They include use of government agricultural extension services, farmer trainers and, local leaders (Chiefs and headmen) (Mafongoya¹, Pers. Comm.). The agricultural extension service is run by the Department of Field Services of the Ministry of Agriculture, Food and Fisheries (MAFF),

¹ P. Mafongoya, Project Leader for ICRAF, Chipata, Zambia. August, 2000.

and employs agricultural extension officers who work directly with the farmers. The farmer trainers are a group of farmers that were selected and specifically trained in agroforestry techniques so that they could train other farmers in return. Most of them are women who belong to the District Women Development Association (DWDA) though others are farmers that have been involved with planting improved fallows for some time. The latter group comprises both male and females. Local leaders comprise village headmen (leaders responsible for running the village) and Chiefs, who are rulers of a larger portion of land that is made up of a number of villages. They have responsibility over the village headmen.

The government extension service has had its own limitations, one of which is the length of time it takes them to pass on information on new technologies to the farmers (Katanga, *et al.*, 1999; Mitti *et al.*, 1997). As researchers are anxious to see that farmers adopt this technology, they have been helping to find other ways of reaching the farmers more effectively. Alternative pathways being promoted are the use of farmer-trainers and local leaders (chiefs and headmen). The use of farmer-trainers, as a pathway, requires that specialists in various aspects of the technology train some farmers so that they can train their fellow farmers in return. It is hoped to reach more farmers in this way.

On the other hand, local leaders have been identified as being influential and with the capability to easily mobilise their people for meetings (Mafongoya², Pers. Comm., 2000). In these meetings, important issues concerning their livelihoods are discussed. Since improved fallows are one way of improving people's livelihoods, it is hoped that such gatherings could be opportunities for disseminating agroforestry technologies.

Although these pathways have been used to try and disseminate improved fallow technology in the past, it is not yet known which is the best way of reaching out to the farmers in order to have greater impact. It is therefore necessary to establish the most cost effective and efficient means of information dissemination. To date, no research has been done on the comparative advantages of the different pathways, hence this study.

² P. Mafongoya, Project Leader for ICRAF, Chipata, Zambia. August, 2000.

The study is intended to analyse, evaluate and make recommendations on the best dissemination pathway for agroforestry technologies to small-scale farmers.

1.3. Main objectives

This research has the following objectives:

- To investigate and document the various dissemination methods and pathways used to reach farmers of improved fallows.
- To evaluate the cost-effectiveness of the various dissemination pathways used.
- To determine and evaluate an effective dissemination pathway for the improved fallow technology.

1.4. Key Research questions

The essential research questions were as follows:

- What are the farmer's agricultural needs and interests?
- How has information about improved fallows been disseminated to the local farmers
- Which are the most efficient and effective ways of accelerating dissemination?
- What has been the role of the local institutions/extension agents in disseminating this technology?
- Which extension agents have been recognised and used in the dissemination process?

- How effective are extension agents?
 - Is the project attempting to reach all farmers?
 - Is the project reaching the targeted farmers?
 - Are the targeted farmers benefiting from project activities?
 - What effect is the project having on the targeted farmers?

- What impact has dissemination had on the adoption of improved fallows
 - How many farmers have been reached?
 - How many have planted improved fallows?
 - How many have adopted the technology?

- How much does it cost to implement dissemination programs i.e. to train both extensionists and farmers; and reach out to the farmers?

- How sustainable are the various dissemination pathways
 - Do particular pathways require re-investment for them to be sustainable?

1.5. Hypothesis

- Use of farmer trainers to disseminate the improved fallow technology is more efficient and effective than conventional agriculture extension methods.

- Use of chiefs and village headmen is an efficient and effective way of reaching more farmers and accelerating adoption of improved fallows.

1.6. Definition of concepts

Adoption of an innovation refers to decisions to apply an innovation and to continue using it (van den Ban and Hawkins, 1988).

Agroforestry is a dynamic, ecologically based natural resources management system that, through the integration of trees in farm land and range land, diversifies and sustains production for the increased social, economic and environmental benefits for land users at all levels (Huxley and van Houten, 1997).

Chitemene is a type of shifting cultivation system practised in Northern Zambia whereby trees are cut or lopped and burnt during cultivation, and then the area is left to fallow once crop production decreases (van Gelder and O'Keefe, 1995).

Cisala is a local name used in Eastern Zambia to refer to a grass fallow.

Communication is the transmission of information, knowledge and skills to the people.

Dissemination pathway refers to the route by which information and technology reaches the user.

Extension is the communication of advice, information, knowledge and skills to the client to help them form sound opinions and make good decisions (van den Ban and Hawkins, 1988).

Farmer trainer refers to farmer extensionists. These are farmers that are deliberately chosen and trained in improved fallow technology so that they could assist other farmers with basic techniques on their farms.

Improved fallows are planted tree fallows, which are intended to restore soil productivity.

On-farm trials are experiments that are carried out to evaluate new agricultural technologies within the farmers' existing farming system.

On-station trials are experiments that researchers carry out at research stations.

2. BACKGROUND TO AGRICULTURE IN ZAMBIA

2.1. The Agricultural Industry in Zambia

Zambia has high agricultural potential but its development is hampered by factors such as changes in the weather pattern and an unfavourable macro-economic environment (MAFF, 1998). Since 1968, the policy objectives of the agricultural sector have been: *“to assure national and household food security; to ensure that the existing agricultural resource base is maintained and improved upon; to generate income and employment to maximum feasible levels; to contribute to sustainable industrial development; and to significantly expand the sector’s contribution to the national balance of payment”* (MAFF, 1998).

The implementation of the above agricultural policies has been unfavourable in that they have been restrictive and constraining due to too much control and interference by the government (MAFF, 1998). Additionally, the strategies used to implement these policies were unsustainable in that they heavily relied on subsidies. An example is the strategy aimed at developing small-scale farmers, which relied on subsidised credit for inputs and marketing. As a result, policies and strategies failed to stimulate growth of the sector. Until recently, the sector lacked private sector participation. The agricultural sector received huge amounts of government and donor financial resources yet it concentrated all efforts in the production of a single crop - maize. The performance of the sector between 1968 and 1991 has been described as poor (MAFF, 1998).

The realisation of the poor performance of the agricultural sector precipitated the government’s decision to embark on agricultural policy reforms. These were part of the economic reforms pursued under the Structural Adjustment Programme (SAP) (MAFF, 1998). The aim of the policy reform is to liberalise the agricultural marketing and promote private sector participation in the development of agriculture.

2.1.1. SAP and the small-scale farmers

Implementation of the Structural Adjustment Programme (SAP) has changed the face of the agricultural industry in Zambia (MAFF, 1998). The government has withdrawn from direct involvement in agricultural marketing and input supply, in addition to freeing prices, removing subsidies, privatising agricultural parastatals, and leasing or selling out public storage facilities to the private sector (MAFF, 1998). Through market liberalisation, the government's aim is to promote the development of the private sector, seemingly because the sector could handle agricultural input distribution and marketing better than the inefficient parastatals, which until recently had dominated the scene. The aim is to encourage export of agricultural produce, while restricting imports (MAFF, 1998). However, in the process, small-scale farmers have been negatively affected. The removal of subsidies on agricultural inputs, particularly chemical fertilisers, has put it outside the reach of beginner, emergent and small-scale farmers, forcing them to maintain increased levels of agricultural output by opening up new forests in areas where land to expand still exists. In areas where such pristine land no longer exists, peasant farmers tend to continuously cultivate the same pieces of land, which leads to land degradation (MAFF, 1998).

2.2. Agricultural Extension Services in Zambia

Agricultural extension involves the communication of advice, information, knowledge and skills to the farming community to help them form sound opinions and make good decisions (van Den Ban and Hawkins, 1988). A major element in the communication of information is that it should be understandable, usable and relevant to the farmer (Chipopola, 1994). Agricultural extension has to interpret research recommendations into a language that the end-user will understand; and that the recommendations relate to the farmer needs. It is also responsible for passing on the farmers' production problems to research for investigations and possible solutions. Therefore, agricultural extension is the vital link between research and farmers (Chipopola, 1994). It is a means of helping people to attain sustainable livelihoods and satisfying lives (Jones, 1986).

The objective of Zambia's national agricultural extension policy is summarised as, "*To encourage the adoption of proven technical innovations and improved organisational skills by all those (including women) who derive their livelihood from exploitation of agricultural land for the production of crop and livestock products*" (MAFF, 1991).

MAFF is responsible for providing agricultural extension services to small-scale farmers (Kwesiga and Kamau, 1989). The ratio of front line extension staff to farmers averages 1:300 and is said to be less than one third of what is required to address the needs of all small-scale farmers in the country. The effectiveness of this force is reduced by the large geographic units that each extension officer has to cover, low pay, training bias towards promotion of hybrid maize, and inadequate funding for field allowances, transport and other operating costs. Farmer training at some farmer training centres is hampered by lack of audio-visual equipment as well as generators to provide power. Agricultural extension staffs in MAFF are also currently impaired by logistical problems to do their work, such as lack of fuel and bicycles (Peterson, 1999).

2.2.1. Communication in extension

Communication lies at the core of any extension programme. Without good communication, new concepts or techniques will not reach the people who might benefit from them. An extension effort should arise from the felt needs of the people, not simply the availability of a new process. Good communication helps people to express their needs in an acceptable form and also to relate their needs to available resources of techniques and funds. Communication attempts to bridge the gap between the sources of ideas and potential users of them (FAO, 1987). It attempts to make available information or skills in a form the public can understand, examine critically, and incorporate into their regular practice, if they can see any benefit in applying them.

New ideas would not be accepted readily if they appear to counter some established local customs, beliefs, religious or family practices, or a farmer's accumulated understanding of how his land should be farmed (FAO, 1987). The possibility of any new idea being adopted widely can only be judged against a sound knowledge of local traditions.

Identifying a barrier in traditional practices and a breakthrough point may be as important as the new technique itself in changing practices. Communication must therefore seek to integrate people's culture, attitudes, knowledge, practices, perceptions, needs and problems in the planning and implementation of programmes to guarantee that they are effective and relevant (Richardson and Paisley, 1998).

While information can be transmitted in many ways, the perceived value of that information and how it is used depends on the form of the extension system (its institutional design) and on the communication process associated with it (NAS, 1983 quoted in Falconer, 1987).

2.2.1.1. *The Communication process*

Four basic elements have been identified in the process of communication as shown in figure 1 (FAO, 1987):

- The sender or communicator of the idea
- The message to be sent
- The channel or means of communication; and
- The receiver of the message or the audience

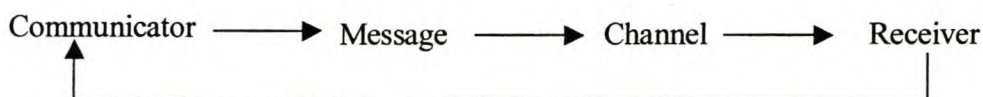


Figure 1: The communication process (Adapted from Forestry Extension Methods by FAO, 1987)

When the receiver responds to a message, this is termed feedback and the Sender-Message-Channel-Receiver process is reversed. In practice, the feedback or response should receive as much attention as the message itself (FAO, 1987). A message, which is either not understood or not acceptable to a community, is valueless, no matter how often it is repeated.

2.2.1.2. The channels of communication

These may be classified as visual, spoken and written. There are also combined methods, which are more effective than any of the channels used in isolation. Each method however has its advantages and disadvantages (FAO, 1987; FAO, 1989). Extension officers must adapt their methods to the particular subject, to the ability of the audience to understand the different techniques used and to the facilities available. Usually, they will employ a combination of two or more channels of communication in one meeting or presentation.

Communication would be said to have taken place if the receiver acquire knowledge, or if they begin to feel a new procedure may offer some benefits and decide to adopt a new technique (FAO, 1987). It is therefore important for the communicator to study the client in order to know their abilities, interests and background before deciding on what form of communication to take. Both methods and channels of communication that are used should make ideas clear and accepted.

There are barriers that prevent communication to take place. Communicators must therefore anticipate these barriers and try to preclude them.

2.2.2. Institutional structure of agricultural extension in Zambia

MAFF operates an agricultural extension service to provide advisory services to farmers in order to improve the quality of farming (MAFF, 1998). There have been major changes in extension policy and training in the past few years. The system has been re-oriented to serve smallholder expansion. However, the revisions have been limited by recent economic conditions (Kwesiga and Kamau, 1989).

2.2.2.1. Organisation at District level

The District is headed by a DACO (District Agricultural Co-ordinator) who is supported by subject matter specialists. Each district is divided into blocks and each block is

divided into camps. The block officer supervises the camp officer administratively and technically (Chipopola, 1994). The camp constitutes the ultimate level of extension outreach (Mitti *et al.*, 1997). The camp officer takes technical messages to farmers and passes on farmers' experiences and problems to subject matter specialists at the district office. The camp officer is the main tool for technology transfer and therefore needs to be knowledgeable to be an effective tool. S/he needs to know the farmers in the area, their problems and their immediate needs (Chipopola, 1994), and is expected to have regular contact with farmers (Mitti *et al.*, 1997).

2.2.3. Extension approach

There are many approaches and methods (visual, spoken and written) of extension. FAO (1988) identifies approaches as follows: the general extension approach; the commodity specialised approach; the training and visit approach; the agricultural extension participatory approach; the project approach; the farming systems development approach; the cost-sharing approach; and, the educational institutional approach. What approach and method one gets to use is largely dictated by the availability of resources. Although these approaches and methods are many, Falconer (1987) indicates that they can all be grouped into two categories namely the top-down (one-way communication) approach and a bottom-up (two-way communication) approach.

The top-down approach is a one-way information delivery system based on the assumption that productivity and income of the client are low because of lack of improved technology. It focuses on selling a technical package or improved practice, changing attitudes and overcoming uncertainty (Falconer, 1987). They feature technology transfer from central research organisations to extension specialists to field extension personnel to farmers (Axinn, 1997). Farmer participation is only as a recipient of information. Lack of full participation in aspects of planning and implementing programmes makes this approach to be less effective than approaches where the farmers participate in all aspects (Axinn, 1997).

Agricultural extension service in Zambia has gone through a number of stages over the years, from the military approach, individual farm visits approach, to the training and visit system approach, all characterised to a greater or lesser extent by a 'top-down' planning (MAFF, 2000b).

The Zambian national extension service, like many other developing countries, has experimented with various versions of the 'training and visit' system (T&V) for over a decade now (Mitti *et al.*, 1997). The extension strategy namely training and visit system was developed by Daniel Benor during the 1970's after he had made a study of all the constraints which were confronting extension systems in many parts of the world. The system was first tested on a trial basis in India and Turkey. The use of the system expanded rapidly to many countries. The World Bank subsequently made it obligatory that countries, which applied for loans in order to establish or update their extension systems, had to change to the T&V system in order to qualify for loans (Williams and Bembridge, 1990). In Zambia, the T&V system has been adopted since 1978 as part of the World Bank funded integrated rural development programmes.

The T&V extension strategy was designed to ensure that field level extension workers are regularly trained, usually fortnightly, within a systematic time-bound programme of visits to contact farmers and groups. Information and skills taught to farmers is co-ordinated with practices they should be carrying out on their fields during that particular time of the year, usually focusing on specific selected farming practices of the most important agricultural enterprise in the area. The contact farmers are expected to spread the message to their neighbours or follower farmers (Williams and Bembridge, 1990). Jones (1986: 259) describes it as "*an intensive and highly specialised form of extension*". He further states that, "*it requires a high degree of professionalism, relatively high ratios of extension staff to farmers, frequent staff training, the intensive and regular supervision of field staff and a strict adherence, by extension workers to a predetermined schedule of farm visits to pre-selected contact farmers*".

No deliberate evaluation of the T&V system has been done or initiated by MAFF to establish its performance. However various NGOs have tried to analyse the system and

in most cases criticised the agricultural extension service. The T&V system was found to be very costly and rigid. This system is also not demand driven in that it gives no opportunity to farmers to make decisions (Lungu³, Pers. Comm., 2000).

2.3.4. Developments in agricultural extension in Zambia

The failure by agricultural extension services to make an impact over the long term has stimulated the interest in new or more effective approaches (Duvel, 2000). People's participation is becoming the central issue of our time and participation requires communication (Fraser and Villet, 1994). In light of the criticism that the agricultural extension system has received, MAFF has been trying to find the best ways to improve the extension service. There is a proposal to adopt the participatory extension approach (PEA). Already, 27 districts have been selected as pilot areas. Sensitisation and training are under way for trainers who are expected to train field staff in return. Guidelines for implementation of the PEA have been drawn (MAFF, 2000b). Introducing participatory approaches is seen as a way to increase coverage and obtain commitment from the farmers and make extension programmes more relevant (Hedden-Dunkhorst and Mollel, 1999).

In the PEA, the community is considered as a basic unit for implementing the programmes (van Crowder, 1998). Farmers are key actors and participate in all extension processes such as project appraisal, participatory monitoring and evaluation. The bottom-up approach is followed in which roles of farmers are increased. Initiatives start at the grassroots level and are then submitted to higher levels (van Crowder, 1998).

2.3. Agroforestry research in Zambia

Diagnostic and Design studies of smallholder agriculture in Eastern Zambia were done in 1986, with research taking root in 1987. The results of these studies identified a serious breakdown of traditional strategies to sustain production of food, fodder and fuel wood

³ J. P. Lungu, Deputy Director of the Field Services Department, Ministry of Agriculture, Food and Fisheries, Lusaka, Zambia. August, 2000.

(Mafongoya *et al.*, 1998; Ngugi, 1988). Low crop yields were found to be a major problem facing farmers in the districts of Chipata and Katete (Ngugi, 1988).

Agroforestry research in Zambia has mainly been done in Eastern Province. The land use system in the Province is the maize/livestock type. Although the problems of declining soil fertility are widespread throughout the country (Kwesiga and Kamau, 1989), Eastern Province was selected for agroforestry research and development because of its high potential as the breadbasket of the country (Mafongoya *et al.*, 1998). In this province too, land pressures, resulting in low crop yields and household food insecurity, have shortened the traditional fallows. Therefore, alternative technologies are required to address these problems. Developed technologies would be useful if they considered indigenous knowledge that exists among farmers. For example, fallowing has been seen as an entry point for improved fallows, since people in the Province already use short rotation grass fallows (Mafongoya *et al.*, 1998).

2.3.1. On-station and on-farm trials

2.3.1.1. On-station trials

Agroforestry research interventions to address the declining soil fertility problem, developed as a result of the D&D studies, were initiated at Msekera Research Station in Chipata from 1987. Because short duration improved fallows using fast growing, nitrogen fixing leguminous trees appeared to be a promising alternative to the natural fallows for increasing the fertility of nitrogen-depleted soils (Phiri *et al.*, 1999b), this approach was chosen initially.

In on-station trials, improved fallows using *Sesbania sesban* seedlings transplanted from nurseries were found to greatly increase maize yields (Kwesiga and Coe, 1994; Kwesiga *et al.*, 1999). Other leguminous species tried along side *Sesbania sesban* include *Tephrosia vogelli*, *Sesbania macrantha*, *Cajanus cajan*, *Calliandra calothyrsus*, *Flemingia macrophylla*, *Gliricidia sepium*, *Leucaena leucocephala* and *Senna siamea*

(Kwesiga *et al.*, 1999). The positive results obtained from these on-station trials encouraged researchers to initiate on-farm trials.

2.3.1.2. *On-farm trials*

On-farm trials are experiments that are carried out to evaluate new agricultural technology within the farmers' existing cropping and livestock systems (Huxley and van Houten, 1997). On-farm research on improved fallows in Eastern Zambia was done for the following purposes: to assess biophysical and economic responses under farmer management; to expose the technology to potential extension agents and users; to obtain valuable feedback from farmers and extension agents on problems and performance; and to assess how farmers used and modified the technology to suit their needs (Mafongoya *et al.*, 1998).

On-farm research trials started in 1991 (Kwesiga *et al.*, 1999). Since then, the number of farmers planting improved fallows has been increasing rapidly, from 4 in 1991/92, to 204 in 1994/95 and then to 3000 by 1996/97 (Franzel *et al.*, 1999) and to 7000 in 1999/2000 (MAFF, 2000a). Three types of on-farm trials have been identified in agroforestry experiments viz. types 1, 2 and 3 trials (Mafongoya *et al.*, 1998). A description of each type of trial as given by Franzel *et al.* (1998) is detailed below.

Type 1 trial. Researcher-designed and managed. These trials are simply on-station trials transferred to farmers' fields but still managed by researchers. They are useful for evaluating biophysical performance and require the same design rigor as on-station research. Since they take place on farmers' fields, they are generally more representative of farmers' biophysical conditions, such as soil type, field management history, flora, and fauna, than are on-station trials (Shepherd, *et al.*, 1994). However, they are usually more expensive and more difficult to manage than on-station trials; they often involve renting land from farmers, guarding the trials, and bringing labourers from the station to implement them. In this type of trial, accurate information on interactions between the biophysical environment and management can be obtained. For example, because there is often a limited range of environments on a research station, it is not possible to assess

how different species in an improved fallow trial compare on different soil types. This is made possible in these type 1 trials. As with on-station trials, farmers' assessments are not a main objective of type 1 trials although farmers' feedback on the different treatments, collected in a systematic manner, is useful (Sperling *et al.*, 1993).

Type 2 trials. Researcher-designed and farmer-managed. Here, farmers and researchers collaborate in the design and implementation of the trial. The trial follows the conventional scientific approach to conducting an experiment: one or more test treatments are laid out in adjacent plots and compared to a control treatment(s). Researchers consult farmers on the design of the trial and each farmer agrees to follow the same prototype (or chooses one of several possible prototypes), so that results may be compared across farms. Farmers are responsible for conducting all of the operations in the trial. Usually plots are as large as is possible, often 200 m² to 400 m², and not replicated. In statistical analysis, farms are combined as replicates. Therefore, the number of farmers involved may need to be large (30-50) to allow stratification of farmers according to differences in their biophysical or socio-economic circumstances or management strategies.

In type 2 trials, reliable biophysical data over a broad range of farm types and circumstances are required. The trials also facilitate the analysis of costs and returns. Inputs, such as labour, and outputs, such as crop yields, are relatively easy to measure because plot size is large and uniform. The trials are also useful for assessing farmers' reaction to a specific practice and its suitability to their circumstances. Farmers are encouraged to visit each other's trials and to conduct group field days to assess the practice at different stages of growth.

Type 3 trials. Farmer-designed and managed. In type 3 trials, farmers are briefed about new practices through visits to field stations or type 1 and type 2 trials. They then experiment with the new practices, planting as they wish. They are not obliged to plant in plots or include control treatments. Researchers monitor the farmers' experiments, or a sub-sample of them, focusing on their assessment of the new practice and their innovations. In addition, farmer-to-farmer visits and meetings are useful so those farmers

can compare their experiences and assessments. Any farmers experimenting with a new practice could be said to have used type 3 trials, regardless of whether they obtained planting material and information from researchers, other facilitators, or other farmers.

Biophysical measurements are most meaningful in type 1 and 2 trials; they are less useful in type 3 trials because each farmer may manage the practice in a different manner. Type 2 trials are well suited for collecting parameters (e.g. labour use) for financial analysis; such data are difficult to collect in type 3 trials because plot size and management vary. They can be collected in type 1 trials but will be less relevant to farmer circumstances. Farmer assessment may be more accurate in type 3 trials for several reasons. Because farmers control the experimental process, they are likely to have more interest and information about the practice. Furthermore, because type 3 farmers usually have less contact with researchers, their views of a technology are less influenced by researchers' views. Finally, whereas it is often necessary to provide inputs to farmers in type 2 trials to ensure that results are comparable across farmers, no inputs, with the possible exception of planting material, are provided in type 3 trials. Thus farmers' views in type 3 trials are more likely to be sincere than in type 2 trials, where positive assessments may simply reflect the farmers' interest and satisfaction in obtaining free inputs and interaction with researchers.

Table 1: Features of the three different ICRAF on-farm trials

Objective	Trial type	Trial design	Trial management
Biophysical feasibility	1	Researcher	Researcher
Profitability: farmer assessment of prototypes	2	Researcher	Farmer
Acceptability: farmers own innovations and assessments	3	Farmer	Farmer

Source: Ayuk *et al.* (2000).

2.3.2. Research initiatives

The agroforestry technologies that have been developed and tried in Eastern Zambia are those appropriate to the maize/livestock land use system. They are meant to address the problems identified during the D&D as follows: low soil fertility, dry-season fodder shortage for livestock, and fuel wood shortage caused by agricultural expansion into marginal areas leading to severe deforestation in some places and soil erosion. Subsistence or small-scale farmers dominate this land use system (Kwesiga *et al.*, 1993).

2.3.3. Agroforestry technologies

Several agroforestry technologies have been tried since 1987. These include improved fallows, hedgerow inter-cropping, biomass transfer, fodder banks and woodlots (Kwesiga *et al.*, 1993).

Improved fallows: Trees are a component of naturally regenerating fallows in many traditional shifting cultivation systems throughout Africa and the rest of the tropics. However, with increasing population pressure the inevitable need for shortening the fallow period and increasing cropping intensity has been well recognised. Yet the short fallows cannot maintain soil fertility at similar levels as those achieved in traditional shifting cultivation. As a result, the concept of improved fallows was pursued. This involves the planting of fast growing, nitrogen fixing and deep-rooting trees to enhance and maintain soil fertility over a short period of time (Cooper *et al.*, 1996; Lungu, 1996; Szott *et al.*, 1999). Improved fallows work and farmers are already trying them.

The biophysical performance of improved fallows in researcher-designed trials has been excellent (ICRAF, 1996; ICRAF, 1997). Maize yields following a one-season *Sesbania* fallow were over 2.5 times higher than those following a continuous cropping or natural fallows. In farmer managed trials, yields following a two-year *Sesbania* fallow increased from 0.3 to 1.3 Mg ha⁻¹ in continuously cropped maize to 2.3 to 4.8 Mg ha⁻¹ following an improved fallow (Kwesiga *et al.*, 1999).

Hedgerow inter-cropping: This technique is synonymous with alley cropping. Trees are grown as spatial mixtures in hedges, typically spaced 4-6 m apart with a within-hedge spacing of 0.25 to 0.5 m. Crops are grown between the hedges and tree biomass, obtained through pruning during the cropping period, is added to the soil as green manure. Results have been mixed and in general disappointing (Cooper *et al.*, 1996). However, some improved fallows have been adapted to function as hedgerows.

Biomass transfer: This involves transferring tree or shrub biomass from distant areas to crop production fields to maintain soil fertility and crop yields. Litter is used directly as green manure or dried and stored for later use, especially if the material is collected during a non-cropping period when the demand for labour is low (Cooper *et al.*, 1996). Alternatively, litter can be treated and mixed with manure. In Chipata, biomass transfer experiments are still being carried out in farmers' vegetable gardens and the results are forthcoming.

Fodder banks: Shortage of high quality dry-season fodder has been recognised as a constraint to ruminant production in the tropics of Africa. Crop residues are utilised as fodder and seldom returned to the soil. Also, natural pastures and crop residues are of low feed quality, and animal condition and performance always declines during the dry season (Cooper *et al.*, 1996). Research has been done to identify species that are suitable for fodder. Information is available on the potential of trees to provide high quality fodder, their adaptation to specific environmental conditions, the range of farm niches where they can be planted and appropriate management regimes to optimise their production and impact. Widespread adoption of this technology has not yet occurred (Cooper *et al.*, 1996).

Woodlots: Refer to a small plot of trees grown for fuel wood, which can also provide small timber and poles (Huxley and van Houten, 1997). There is currently shortage of fuel wood in many countries, resulting in increasing deforestation. To help reduce these problems rotational woodlots have been developed. Fast growing and productive trees with good performance have been identified, but in Zambia, they have not yet been tested on farmers' fields (Ayuk *et al.*, 2000).

3. DESCRIPTION OF THE IMPROVED FALLOW INNOVATION

3.1. Traditional fallow

Fallow commonly refers to the resting state of an agricultural field (Szott *et al.*, 1999). It is a natural practice of land use, an integral part of the shifting cultivation system (Lungu, 1996), is therefore not a new concept (Kwesiga *et al.*, 1996). Historically fallows have played an important role in maintaining the productivity of farming systems in both temperate and tropical areas. Many farmers in the tropics still use fallows as part of their farming systems (Szott *et al.*, 1999). For example, in Northern Zambia, farmers use the *chitemene* system of farming whereby trees are lopped or cut and burnt during the period of cultivation, and then the area is left to fallow area once production is low. In Eastern Zambia, farmers have always relied on short or grass fallow periods, locally known as *cisala*. Grass fallows are of varying duration, usually one to five years. Once farmers discover that maize yields are not sufficient to warrant further cultivation, they allow fields to rest for an extended period of time (Lambert, 1996).

Increasing land pressure (arising from human population growth) has undermined the ability of traditional fallowing to maintain and restore soil fertility in sub-Saharan Africa (Mafongoya and Dzwela, 1999). In a shifting cultivation system, soil fertility is dependent on the regeneration of the natural secondary vegetation. The shifting cultivation cycle traditionally consisted of three to 15 years of growth of unmanaged secondary vegetation, which is cut and burned at the initiation of a one to four year long cropping cycle (Szott *et al.*, 1999). This cropping cycle alternated with three to 15 years of fallow, and was sufficient to restore soil fertility.

However, in recent years, the duration of fallowing has been declining as a result of land pressure (Mafongoya and Dzwela, 1999). Farmers have been finding it difficult to maintain long fallows as required for traditional systems. They are forced to rest their land for shorter periods or even crop continuously without fallowing the land at all (Rao *et al.*, 1990). As the duration and intensity of fallowing decreases, so does the ability of the natural regeneration of vegetation to restore soil fertility (Mafongoya and Dzwela, 1999). Instead, soil fertility may be replenished through nutrient inputs from organic and

inorganic sources, but the use of mineral fertilisers is constrained by prohibitive purchase prices (Phiri *et al.*, 1999a). The shortening of traditional fallows combined with little or no use of fertilisers has had negative consequences on agricultural productivity and agroecosystem integrity in the tropics (Szott *et al.*, 1999). Hence, there is need to investigate alternative organic-based technologies for small-scale farmers.

3.2. Improved (managed) fallows

Managed fallows, which restore agricultural productivity more rapidly than natural fallows, have shown potential as a solution to declining soil productivity caused by shortened natural fallow periods (Raintree, 1986). In addition, they provide useful products such as fuel wood and medicine. They also help to control erosion, suppress weeds and provide shade.

During the fallow phase, the trees are able to utilise nutrients in the topsoil and also capture some from deeper soil layers where shallow rooted crops are unable to reach. The captured nutrients are then returned to the topsoil through litter fall and decomposing roots in a process called ‘nutrient cycling’. As a result of these processes organic matter, nitrogen and other nutrients are added to the soil, thereby improving the soil structure, including breaking the hard pan (MAFF, 2000a).

The process of establishing improved tree fallow species is similar to that for most grown trees. Some of the species require nursery establishment and later transplanting as bare root seedlings (*Sesbania sesban*) or containerised seedlings (*Gliricidia sepium*). Others, such as *Cajanus cajan*, and *Tephrosia vogelli*, are directly sown in the field. Once planted out in the field, trees are left to grow for a period of 2 to 3 years, after which they are clear-cut. All the biomass is left in the field except for woody stems and branches that are used as fuel wood. The field is then planted with agricultural crops such as maize, sorghum, beans or any other crops of the farmer’s choice (MAFF, 2000a).

3.3. Benefits of improved fallows

Improved fallows provide numerous benefits in the context of soil quality and agricultural production. Some of the benefits include soil nutrient replenishment, reduction in weed densities, soil organic matter build up, improved soil water content, reduction in soil acidity, and improved soil physical properties (Hartemink *et al.*, 1996; Abubakar, 1996; Place and Dewees, 1999).

Improved fallows reduce competition for light, water and nutrients with the crop in that it is done through relay inter-cropping or sequentially (Sanchez, 1999). The common practice in Zambia is for farmers to grow improved fallows sequentially with the crop. Since improved fallow species are deep rooted, they are able to utilise subsoil water and nutrients, which would otherwise not be available to annual crops during the dry season and droughts. This enables biomass accumulation of improved fallows to occur even during the dry season. Consequently, total farm production is greater with improved fallow-crop rotations than with continuous cropping even when crop production is skipped for one or more seasons with improved fallows (Sanchez *et al.*, 1997 quoted in Sanchez, 1999).

Improved fallows increase N stocks in vegetation and topsoil through the biological nitrogen fixation and retrieval of inorganic nitrogen from subsoil layers, where woody species can access nitrate that crops cannot (Hartemink *et al.*, 1996). The large quantities of N that are accumulated *in situ* by improved fallows are returned to the soil as leaf and root litter. In some cases, the amount of N that is available from improved fallows is not enough to give a good harvest. It is therefore necessary that supplementary top dressings of mineral fertilisers be added when the planted crops require it (Sanchez *et al.*, 1997; quoted in Sanchez, 1999). Where phosphorus is deficient however, mineral P fertilisation must be used in conjunction with improved leguminous fallows to overcome P constraints to crop production (Jama *et al.*, 1998; quoted in Sanchez, 1999). In Kenya, a sesbania fallow was also reported to have alleviated K deficiency to a subsequent maize (*Zea mays* L) crop by retrieving it from subsoil and then recycling it through the vegetation to the subsequent crop (Sanchez, 1999).

Improved fallows have the ability to reduce weeds in crops. For example sesbania fallows reduced the occurrence of the parasitic weed *striga asiatica* (L.) Kuntze in subsequent maize crops (Kwesiga *et al.*, 1999) by promoting suicidal germination and increasing soil N (ICRAF, 1996).

Litter fall from improved fallows can also provide carbon as an energy source for soil microbes to enhance nutrient cycling (Palm *et al.*, 1997) and soil C sequestration. Consequently, soil physical properties and soil water retention are improved (Torquebiau and Kwesiga, 1996).

These benefits are what make improved fallows advantageous over inorganic fertilisers, which are incapable of producing many of them (Place and Dewees, 1999). Improved fallows also provide fuel-wood, the main source of energy for cooking in the rural areas (Leakey and Sanchez, 1997). This fuel-wood reduces the need for gathering wood from nearby forests or woodlands, or walking long distances to search for it and also the problem of transporting it to the household. It therefore reduces on the tasks of women, considering that fuel-wood collection is mostly the woman's responsibility. Farmers need to hear of the potential benefits, of increased yields or reduced costs. Only then would they adopt widely and the transition will be underway (Pretty, 1995).

3.4. Socio-economic factors affecting rate of adoption of improved fallows

Research into the rate at which various innovations have been adopted indicates that there are not only identifiable 'people' differences in innovativeness, but there are also 'innovation' differences that may affect the rate of adoption (Lees, 1990). Some of the attributes of innovation that may be used in analysing and predicting the rates of adoption include relative advantage, compatibility, complexity, trial ability and observability (Rogers, 1983), described below.

Relative advantage refers to the degree to which an innovation is perceived as being better than the idea it supersedes. An innovation is perceived as *compatible* when it is consistent with the existing values, past experiences and needs of potential adopters. An idea that is more compatible is less uncertain to the potential adopter. *Complexity* is the

degree to which an innovation is perceived as relatively difficult to understand and use. Research evidence suggests that the complexity of an innovation, as perceived by members of a social system, is negatively related to its rate of adoption. The degree to which an innovation may be experimented with on a limited basis is referred to as *trial ability* where as *observability* is the degree to which the results of an innovation are visible to others. Both trial ability and observability of an innovation are perceived by members of a social system as being positively related to rate of technology adoption (Rogers, 1983).

In analysing factors that affect the adoption potential of improved fallows by farmers, the above attributes have been grouped into three components (Franzel, 1999). These are feasibility, profitability and acceptability of the technology. *Feasibility* refers to whether farmers have the required information and resources and are able to plant and maintain the fallows. *Profitability* is whether the financial benefits obtained from using the technology are higher than for alternative technologies, from the farmer's perspective. *Acceptability* concerns whether farmers want to use improved fallows. It includes a variety of criteria, in addition to profitability and feasibility, such as riskiness, suitability to accepted gender roles, cultural acceptance, and compatibility with other enterprises (Franzel, 1999). The following is a summary of Franzel's (1999) findings of such factors.

3.4.1. Feasibility

Labour is a constraint for farmers, at the time of planting and weeding trees, because it coincides with the peak time for planting and weeding crops. In certain cases, labour does not constrain adoption but it limits the area that farmer's plant to improved fallows. Farmers have however expected high benefits from improved fallows in Zambia hence their motivation to invest labour to plant and weed trees during the peak times. The improved fallow method still has advantages over other agroforestry technologies in that it allows for cutting trees during the slack season before land preparation begins. Additionally, trees can be established by direct seeding or transplanted as bare-root seedling, and can be planted in an open field or inter-cropped with food crops during the

year of establishment and hence form an equivalence of a hedgerow (see section 3.3.3.above).

Farmers require institutional support to initiate the technology. Support can be in terms of technical or material support to enable farmers to establish and maintain improved fallows. In Zambia, support has been provided through seed distribution and training of extension agents and farmers in nursery development and fallow management. Farmers have had no problems with nursery establishment as most of them have experience with seedling production for their garden crops.

3.4.2. Profitability

Economic analyses of improved fallows have been conducted based on results from farmer-managed trials (Franzel *et al.*, 1999) and also from on-station trials in Zambia (Kwesiga *et al.*, 1999). Improved fallows were compared to continuously cropped maize with and without nitrogen fertiliser. Overall results showed the improved fallows had slightly lower returns than fertilised fields (Franzel *et al.*, 1999). Unlike fertilised fields, improved fallows do not involve any cash expenditure and the benefits are spread over a two to three year period. Economic analysis from on-station trials indicates that a two-year fallow is more profitable than a one or three-year fallow (Kwesiga *et al.*, 1999).

As for the sensitivity analysis, results were dependent on the establishment method and the amount of labour required for planting and weeding. Both bare root and potted seedlings perform just as well, as long as bare root seedlings are planted out within a few hours of removal from the nursery. However, bare root seedlings require much less labour and cash outlay than the potted ones (Franzel *et al.*, 1999; Kwesiga *et al.*, 1999).

3.4.3. Acceptability

a. Perception of soil fertility problem

When farmers identify soil fertility as a problem, they are more likely to adopt improved fallows.

b. Past use of measures for improving soil fertility on annual crops

Farmers' knowledge of the usefulness of improving their soil fertility and their eagerness to find a substitute means could increase their enthusiasm to adopt improved fallows. In Zambia for example, farmers previously used chemical fertilisers to improve soil fertility. Now that they can no longer afford fertiliser but are aware of the need to improve soil fertility to increase productivity, they have been keen to try improved fallows as an alternative (Franzel, 1999).

c. Current fallowing of land

Farmers whose current farming system involves fallowing their land are more likely to practise improved fallows than those that do not. Not all of them may adopt the improved fallows though. There are farmers who fallow periodically as part of a rotation and others who fallow out of desperation when yields from a particular field drop below a certain level. Both groups use fallows to improve soil fertility and usually find improved fallows attractive. They only differ in the manner in which they use the practice (Franzel, 1999).

d. Economic importance of annual cropping

Farmers invest in improving their land for annual crop production if that land is a critical part of their livelihood strategy and if the investment competes favourably with alternative opportunities. With agriculture accounting for 84% of household

income source in eastern Zambia (Celis *et al.*, 1991) farmers are eager to invest in improved crop production as evidenced by past high rates of fertiliser use.

e. Wealthy level

A wealth ranking exercise was done by community members in selected villages in Eastern Zambia to define the different wealth groups and classify households into groups (Phiri *et al.*, 1999b). Based on the results of the exercise, an association between wealth and use of improved fallows was established. Results indicated that improved fallows were planted by over half of the 'well off' farmers, with only 22% of the 'poor' and 16% of the 'very poor' also planting. Overall there are no important barriers preventing any wealth class from using or adopting improved fallows. Considering that fallows require little if any cash input, they are likely to be adopted even by those with very low income.

f. Access to off-farm income

This may conceivably enhance or reduce the adoption potential of improved fallows. If farmers have enough income to purchase food during the period of the fallow, they are likely to leave their piece of land on fallow. This would be the case where intensive agriculture is practised. Equally, when some family members are engaged in off-farm employment, labour to work on the farm is reduced. This forces families to work only a certain portion of land in a season, or employ someone to work for them. That land which is not cultivated can then be put to fallow. The likely circumstance when off-farm income can reduce adoption potential is when income from off-farm work becomes enough to purchase food for the family, such that they do not totally rely on their farm for livelihood. Such families are not likely to adopt new technologies, as they will be less disposed towards them (Franzel, 1999).

g. Gender

Female farmers provide most of the labour for African food production and almost 30% of the households are female headed. One would expect female participation in the use of improved fallows to be lower because of the lower incomes of women and high chance of not being reached mostly by extension staff whose activities tend to be biased towards males. To the contrary, there is no significant difference between male and female testers in Zambia. Equally, the same proportions of single females to female-headed households whose husbands live away were testing the technology (Phiri *et al.*, 1999b).

h. Cultural impediments

No evidence of cultural factors has been found to limit adoption of improved fallows so far (Franzel, 1999).

3.5. Dissemination of improved fallows in Zambia

At the inception of agroforestry research, the services offered by the agricultural and forestry research and extension were seen as an entry point for the field of agroforestry. These two departments, which fall under MAFF and the Ministry of Environment and Natural Resources (MENR) respectively, were selected due to the nature of the work they were involved in. These include research and extension in all aspects of agriculture for MAFF and management of tree nurseries in the districts from which farmers get seedlings for planting for MENR (Ngugi, 1988). The two activities are important for the dissemination process of agroforestry. Despite the initial identification of the Forestry Department's possible role in disseminating agroforestry technologies to the farmers, their participation in disseminating improved fallows has been very insignificant since the start of the program. MAFF has been solely responsible for the dissemination of improved fallows until the recent involvement of some non-governmental organisations.

3.5.1. Extension methods

There are several extension methods that extension agents commonly use to help farmers form opinions and make decisions. As to which method is used depends on the specific goals and circumstances in which one operates. Extension methods can be grouped into three categories: mass media, group and individual or face-face extension methods (van den Ban and Hawkins, 1988; FAO, 1987).

In attempting to disseminate improved fallows to the small-scale farmers in eastern Zambia, a combination of all the three categories of the extension methods have been used. In the mass media category, radio programmes have been aired on the local broadcasting. The radio is an excellent medium for motivation and for drawing attention to new ideas and techniques but is weak for providing detailed knowledge and training (FAO, 1989).

Recently, television programmes were broadcast although this is restricted to people living in electrified areas and owning television sets. It is expensive to produce programmes and also to pay for airtime. Agricultural programmes are difficult to produce because they require to be done in the field. It is also difficult to localise information for agriculture unless in areas where local TV stations exist, a rare situation in developing countries (FAO, 1989).

Videos have also been shown to groups of farmers that visit the research station. Video is highly effective but it calls for a careful strategy and skilled producers. Pamphlets, leaflets and newsletters have been produced and distributed, and participation in national agricultural shows has been done. Group meetings, demonstrations, field days and tours, in form of farmer-to-farmer exchange visits, have been organised (Katanga⁴, Pers. Comm., 2000). Farmer field days and tours involve collective walking of farmers' fields where new practices being adopted are shown. During the sessions, farmers discuss the strengths and weaknesses of the respective farm, provide insights and suggestions to the farmer, and stimulate number of ideas on the practice. Experienced farmers or

⁴ R. Katanga, Dissemination Specialist for ICRAF, Chipata, Zambia. August, 2000.

programme supervisors (Scarborough *et al.*, 1997) usually facilitate the sessions. Folk media has been used too. Creative use of folk media, in cultures where it is popular and well entrenched, can be a subtle and effective way of introducing development ideas and messages (FAO, 1989). Care is required to ensure that the mix of entertainment and development is appropriate, so furthering the latter without damaging the former.

3.5.2. Dissemination pathways

Dissemination of improved fallows is important if improved fallows have to be taken up and also if they have to have impact on farmers' livelihood. Since on-farm trials were started and results obtained were found to be positive, an attempt has been made to reach out to as many farmers as possible to make them aware of the technology and to assist them to try out the technology on their farms. It is hoped that with increased awareness, many farmers would adopt the technology as a means to mainly improve soil fertility and consequently rural livelihoods. As section 3.5.1. shows, a combination of extension methods have been used and yet the uptake of improved fallows has been slow. It was therefore felt necessary to try three different pathways, who in the process of communication act as communicators, to establish how best to communicate the improved fallow technology to the farmers. The three dissemination pathways that have been and are still being tried are as follows:

1. Government agricultural extension officers
2. Farmer trainers
3. Local leaders (Chiefs and headmen)

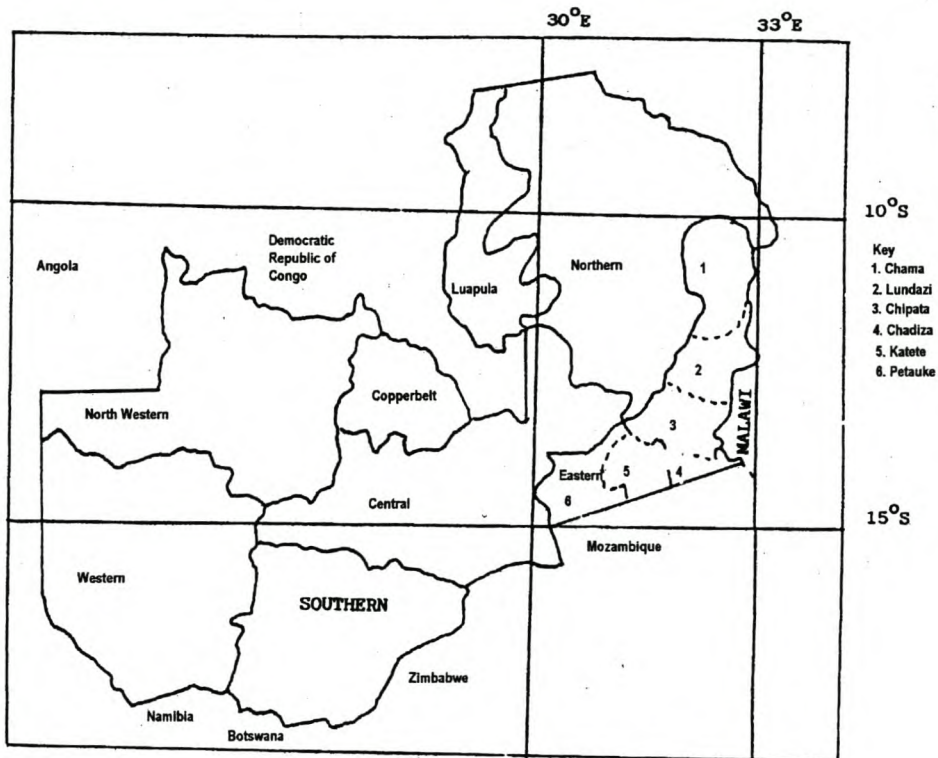
and these pathways are the subject of this study.

4. RESEARCH DESIGN AND METHODOLOGY

4.1. Study area

4.1.1. Location

The Eastern Province of Zambia is located between $10^{\circ} 30'$ to 15° S latitude and $30^{\circ} 25'$ to 34° E longitude. It covers a total area of $69\ 000\ \text{km}^2$, representing 9% of the total land area of Zambia. It shares borders with Malawi to the East and Mozambique to the South. Within the country, it shares borders with Northern and Central provinces to the Northwest and Lusaka Province to the Southeast. The field survey was conducted in three districts of the Eastern Province namely Chadiza, Chipata and Katete (Figure 2).



Adapted from Ngugi (1988)

Figure 2: Zambia, showing districts of the Eastern Province. The study was conducted in Chipata (3), Chadiza (4) and Katete (5)

Chadiza District is located in the extreme South-eastern corner of Zambia between 32° 15' and 33° 00' E longitude and 13° 75' and 14° 30' S latitude. It covers 2575 km², bordering Malawi in the East and Mozambique in the North. It borders with Chipata District in the North and Katete District to the West (Kupanda, 1996). Chipata District is in the Central-eastern part of the Province. It covers 11 986 km². It has borders with Malawi to the East, Lundazi and Mambwe Districts to the North, Petauke and Katete to the West, and Chadiza to the South (Milimo, 1997). Katete District is situated between 31° 45' and 32° 30' E longitudes and 13° 80' and 14° 45' S latitudes. It has borders with Mozambique in the South, Chadiza District to the Southeast, Chipata District in the Northeast, Mambwe in the North and Petauke District in the Southwest [EEOA (Economic Expansion in Outlying Areas), 1998].

4.1.2. Topography

The Province is essentially a plateau and is composed of undulating hills at an average altitude of 900-1500 metres above sea level (Ngugi, 1988). It also contains a section of the Luangwa river valley (300-600 m above sea level). This river valley is part of the Great Rift Valley system, which feeds into the Indian Ocean via the Zambezi River (Ngugi, 1988). Seasonally waterlogged depressions (locally known as dambos) are also common. These form a unique microclimate and are exploited locally for dry season gardens (called *dimbas*). Rock outcroppings are a common feature in this landscape.

4.1.3. Hydrology

Most rivers in the Province are seasonal and flow from December to August. The largest river in the Province is the Luangwa River, which flows from the northern part of Eastern Province to join the Zambezi River in the southern part of Lusaka Province. The Luangwa river basin covers approximately 140 000 km² of land, the majority of which comprises National Parks. The Luangwa River basin is the largest in the country after the Zambezi and the Kafue; it is the major source of fresh and dried fish in the area.

Katete District has no perennial rivers. The Katete, Mzime, Lupande, Myamadzi, Kapoche and Katiula are seasonal streams that run from December to August (EEOA, 1998). The District has 44 constructed dams, which suffer from lack of rehabilitation and maintenance, resulting in problems of siltation, leakage, dense vegetation and damaged walls. Most of these dams are unable to retain sufficient water throughout the year, and are therefore not able to meet the needs of the population.

Chadiza has three perennial sources of water, namely the Nsadzu, Vubwi and the Mwami rivers. There are several dams along these rivers that are used to provide water to the local communities and also for fishing (Kupanda, 1996). Similar rehabilitation and maintenance problems to those of Katete have been experienced in this District.

4.1.4. Climate

The Eastern Province experiences a tropical to sub-tropical climate with three distinct seasons: a warm wet season from November to March; a cool, dry season from April to mid August; and a hot dry season from September to October (Ngugi, 1988). Precipitation averages 800-1000mm per year, although when droughts are experienced, rainfall averages less than 600mm per year. The rate of rainfall exceeds evapotranspiration during the rain season but when there is drought, there is consistent water deficit depending on the moisture holding capacity of the soil. The length of the growing season ranges from 139-155 days. In the wettest month of December, mean monthly rainfall averages 231 mm (Ngugi, 1988).

Average daily temperature minima and maxima vary from 18-31°C during the hottest month of October to 6-23°C during the coldest month of July. Both rainfall and temperatures vary within the Province and within individual districts (Ngugi, 1988).

4.1.5. Soils

The soils of Eastern Province are variable, with the most predominant soil group being sand veldt. The most common soil types are the yellowish-red to light yellowish-brown, loamy sands or sands (acrisols: FAO/UNESCO classification) on well-drained sites and the grey-brown, loamy sands or sands on poorly drained sites. In some cases, these soils are interspersed with red clays and red-brown loam (Ferric luvisols: FAO/UNESCO classification) (Ngugi, 1988).

The sandy loams are moderately leached, well drained and relatively fertile but have generally low water and nutrient retention capacities due to the sandy nature of predominant soil types. They suffer from excessive leaching during the rainy season, but despite this are suitable for both rain-fed and irrigated crop production (Ngugi, 1988).

Light sand loam soils predominate in Chadiza, with low inherent soil fertility and a pH range of 4 to 4.5. About 77% of land in Chadiza is not arable due to topographic constraints such as hills and rocks (Kupanda, 1996). In Chipata, clay and sand loams are dominant. The sandy loams are relatively deep and fertile in some areas, but there is considerable gully erosion in some farmers' fields. In some other areas in and around Chipata, red clays and red brown loams (ferric luvisols) are common, while shallow gravely soils (litho sols) are found on hillsides and escarpments (Kupanda, 1996). In Katete District, the soils are predominantly sandy to clay loams. The soils are commonly yellowish sand with patches of red clay and brown loam. The soil pH ranges from 4.7 to 6.0 (EEOA, 1998).

Areas around the streams and dambos have more fertile alluvial soils. Dark grey or black clays (vertisols) and grey brown loamy sands or sands are found in dambo areas and other poorly drained sites, as well as hydromorphic gleysols (Ngugi, 1988).

4.1.6. Population

In 1990, the total population estimate for Eastern Province was 974 000, which accounted for 11% of the total Zambian population (Ngugi, 1988). The population density in Eastern Province is 25 to 40 persons per square kilometre (Phiri *et al.*, 1999b), in clustered settlements of up to 100 homesteads (Ngugi, 1988). Most villages represent groups of related families.

The average annual population growth rate from 1980 to 1990 was 4%, making it the second highest in the country after Lusaka Province. There are approximately 93.4 males per 100 females in Eastern Province, and 20% of the households are female headed (CSO, 1992).

There are many tribes living in Eastern Province. These can however be classified into the following ethnic groups: Tumbuka, Chewa, Ngoni and Nsenga. Chewa, Ngoni and Nsenga peoples mainly occupy the survey area. The Chewa and Nsenga practise a matrilineal type of kinship, while patrilineal system is found in the Tumbuka and Ngoni culture (Ngugi, 1988).

4.1.7. Vegetation

There are still large tracts of natural forest that cover Eastern Province, mainly miombo and mopane woodlands (Peterson, 1999). Miombo woodland is dominated by species of the genus *Brachystegia*, *Julbernardia* and *Isoberlinia*. Mopane woodlands are mainly concentrated in the Luangwa river valley. *Colophospermum mopane*, a common browse species and host to an edible caterpillar dominate mopane woodlands. Common grasses include *Andropogon spp.*, *Brachiaria spp.*, *Chroris spp.*, *Echinochloa spp.*, and *Panicum spp* (Peterson, 1999).

4.1.8. Agriculture

Eastern Province has approximately 3.8 million ha of arable land (out of 6.9 million total ha) although only 35% of the arable land is currently utilised. Almost 75% of the total labour force in the Province is involved in agriculture, forestry and fishing. The main agricultural products include maize, groundnuts, cotton, tobacco, sunflower and livestock. Eastern Province is the largest producer of groundnuts, one of the three largest producers of maize, and the fourth largest producer of livestock in the country (Celis *et al.*, 1991). About 90% of the farmers earn their living from subsistence agriculture and part time work. Major off-season activities include blacksmithing, basket making, reed mat production, beer brewing, carpentry, charcoal production and gardening (Peterson, 1999).

4.2. Methods

The three districts in which the study was conducted (Chadiza, Chipata and Katete) were purposefully chosen because that is where research and dissemination of improved fallows is underway. The study was undertaken from August 2000 to January 2001.

4.2.1. Sample profile

Four categories of interviewees, farmers, farmer trainers, local leaders and the government agricultural officers working at field level were identified. Farmers were chosen because they are the recipients of the extension service provided for improved fallows. The latter three groups were the major pathways used to disseminate improved fallows to the farmers.

Some key informants were also identified, mostly senior staff from MAFF, the executive members of the DWDA⁵, and staff from ICRAF. Informal interviews were held with

⁵ DWDA was represented by Executive secretaries for Chadiza, Chipata and Katete, namely Misozi Zulu, Mary Mumba and Fadeles Phiri respectively

these groups of people. Secondary data were obtained from studies that have been done on adoption and dissemination of improved fallows in the area.

4.2.2. Instruments used in data collection

Data were collected using questionnaires, which had both open-ended and structured questions (Appendices 1, 2, 3 and 4). A questionnaire was designed for each category of interviewees, namely the farmers, farmer trainers, local leaders and agricultural extension officers. Additionally, informal discussions using a set of pre-determined questions were held with the key informants.

4.2.3. Sample design and sampling techniques

a. Householders

A multi-stage sampling procedure was followed to select the farmers to be included in the survey. From the three districts that were purposefully chosen, Area Women Development Associations (AWDA) were identified. Each district is divided into 10 AWDA. Each AWDA is made up of members from a number of villages. It was difficult to establish the exact number of villages in all AWDA, as records were not readily available for all of them. The ones that could be accessed averaged 10 villages per area. Lists of the names of the AWDA were drawn with the assistance of the executive secretaries of the DWDA in each district, and five ADWAs were then systematically chosen, by drawing a list where every second AWDA was chosen and included in the sample. Lists of the villages in the selected AWDA were drawn. In cases where ADWAs contained less than 10 villages, only one of these was randomly selected, while in those containing more than 10 villages, three villages were randomly selected. A total of 28 villages were finally selected and included in the sample from which farmers were drawn.

Once villages were selected, a representative sample of farmers was selected from each village using a random sample method. In villages where a village register was available either from the village headman or the agricultural extension officer assigned to the area, 10-12 names of household heads were selected at random. Where such lists were not available, random selection of the households was done while already in the village. Before the fieldwork commenced, it was decided that up to 12 households per village be included in the sample, based on the resources and time available. No stratification into gender categories was done for this survey. Household heads were targeted for interview. In cases where the household head was absent, the spouse was interviewed if they owned and cultivated the same piece of land.

b. Farmer-trainers

There is a total of 81 farmer-trainers in the three districts. Considering that the population of the trainers is not large, a total enumeration was intended. However, this was not possible due to some trainers being absent during the period of the survey, and so the sample was reduced to all the trainers that were present in the areas at the time. These included trainers even from those AWDA's that were not included in the sampling area for the farmers.

c. Local leaders

The sample was systematically selected, so that local leaders of every other village were interviewed. Five chiefs were intended to be included in the sample but the bureaucracy involved in meeting them made it impossible to interview them. For the purpose of analysis, the two groups were pooled since the same questionnaire was used to interview each of them.

d. Agricultural Extension Officers

A total enumeration of agricultural extension officers available at the time of the survey was done because there were very few officers in the districts. Some posts were vacant

due to deaths of officers or staff shortage or remoteness of the place. Other officers had just taken leave from duty and could not be reached.

4.2.4. Data collection methods and field work practice

Questionnaires were pre-tested and refined in August in three villages in Chipata district on 10 farmers, 3 farmer trainers, 3 agricultural officers and 2 headmen. All test interviews for each of the categories were carried out at once for logistical reasons. The contact point in each village was the headman, who was also one of the interviewees. Questions were asked in the local vernacular (Nyanja) and answers were recorded in English, following Babbie (1998). Farmers were encouraged to discuss issues freely and reveal some aspects that the questionnaire did not capture. This method conforms to Chambers' (1983) observation that the best way to learn from local people is to sit down, ask questions and listen. The same process was used for key informant interviews.

In each of Chadiza and Katete, two people were trained to assist in administering the questionnaire. These were people that could speak the local language fluently. They also acted as field guides since they were conversant with the location of the various villages included in the sample.

Having obtained permission from the District Agricultural Co-ordinators (DACO) to interview the field officers who are under its jurisdiction, agricultural officers were either interviewed directly or asked to fill in a questionnaire.

4.2.5. Validity and reliability of results

Some measures that were taken to minimise error included pilot testing of the questionnaire, and guidance of the assisting interviewers. The sampling procedure that was followed also ensured that there was representation from the three districts, cutting across all partners of interest in the improved fallow technology. Interviews are a subjective means of investigation in that the interviewer would choose to tell or not tell

the truth. Rural people provide false information for various reasons such as fear, prudence, ignorance, exhaustion, hostility and hope of benefits (Chambers, 1983). They tend to please interviewers by giving them what they want (Pretty, 1995). As a result of this, the reliability and validity of research results are dependent on the extent of truthfulness of the interviewees and their perception of the interviewers (Grundy, 1990).

4.2.6. Data analysis

Data were checked for errors and coded and analysed using SPSS⁶, selected because it makes analysis of both qualitative and quantitative data possible. Descriptive statistics were generated in an attempt to answer most of the research questions.

⁶ SPSS 10.0 for Windows (SPSS, 2000). <http://www.spss.com>

5. RESULTS AND DISCUSSION

Shortcomings and possible sources of error

The timing of a questionnaire survey is crucial to the quality of information gathered. When the survey started in August, it was possible to easily access the people in the villages because they were not involved in agricultural work. As November and December arrived, it became more difficult because most of them were out to their fields the whole day, and it took several attempts to be able to interview them. Farmers value their agricultural work highly because that is their source of livelihood, thus making an appointment with them mattered less than putting in work in their fields. It is therefore important to time and complete such field outside of the agricultural period.

Some of the interviewers used were part of the DWDA. While every effort was made to check on the interviewing method, it was possible that in certain instances they could have influenced the feedback they got from the farmers. Equally the questionnaires filled in by the government agricultural extension officers could have been biased in that they could have only provided information that protected their integrity, knowing that this study focused on their day- to -day activities.

Reports on the extension activities and number of participants to those activities were not up to date for both agricultural officers and farmer trainers. Some information was provided but with many gaps.

Although one of the objectives was to evaluate the cost-effectiveness of the three pathways used, it was difficult to compare costs incurred to disseminate improved fallows alone in that it is considered as just one of the technologies disseminated by MAFF. Isolating it was not possible, and therefore conclusions drawn about the activities of the government agricultural officers will reflect their entire dissemination programme and not improved fallows alone.

5.1. Farmers

5.1.1. Overview of the sample of farmers

In total, 296 households in 28 villages from the three districts of Chadiza, Chipata and Katete were surveyed. The sample was composed of 44% males and 56% females (Table 2).

Table 2: Gender of respondents in the study area, Eastern Province, Zambia

District	Sex of the respondent		Total
	Male (%)	Female (%)	
Chadiza	14.5	16.2	30.7
Chipata	15.2	20.6	35.8
Katete	14.5	18.9	33.4
Total	44.3	55.7	100.0

In this sample, 70% of the farmers had attended school, but of these, only 57% could read and write, the remainder having dropped out of school. Those that could read and write in English accounted for 30%. Numbers of females attending school diminished with increasing education level. Over 70% of females compared to less than 30% of males had not attended school, a common trend in rural areas where investment for boys' education is preferred (Figure 3). The data included in this report reflects the trend of the past decades and there is an anticipated improvement because of the deliberate promotion of 'girl child' education by the government (Pers. obs). Hopefully, by the end of this decade classes will be made up of equal numbers of boys and girls as more girls have a chance to enrol in schools.

Figure 4 illustrates the distribution of the ages within the sampled population, showing that the majority of farmers were less than 50 years of age. As ages of farmers increase, the counts decrease, with fewer farmers being more than 75 years of age. Most of these farmers have lived in these areas since their birth. The majority (76%) of the farmers were married while the single, married, divorced and widowed categories accounted for the remaining 24%.

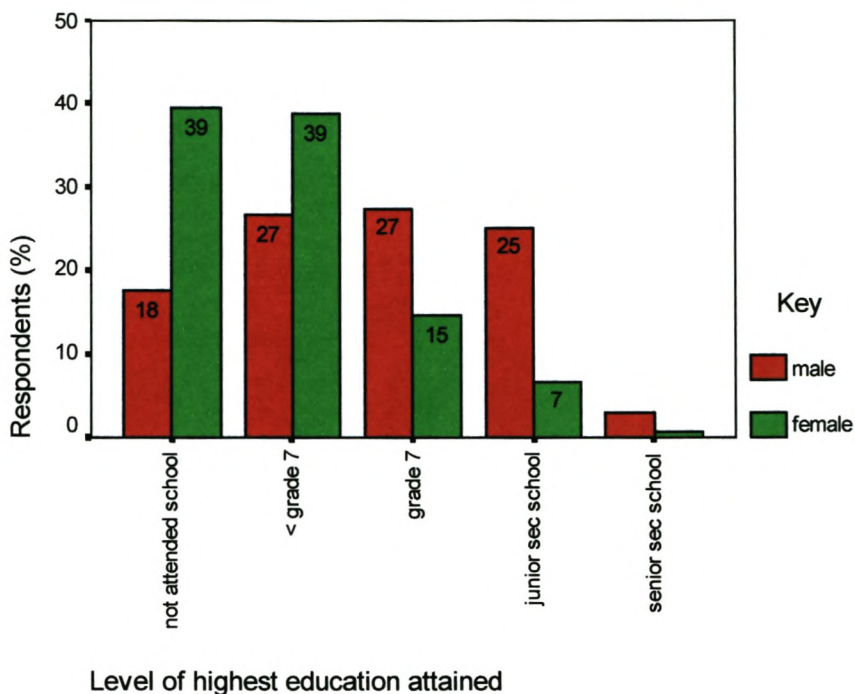


Figure 3: Level of education attained by farmer respondents in the study area, Eastern Province, Zambia

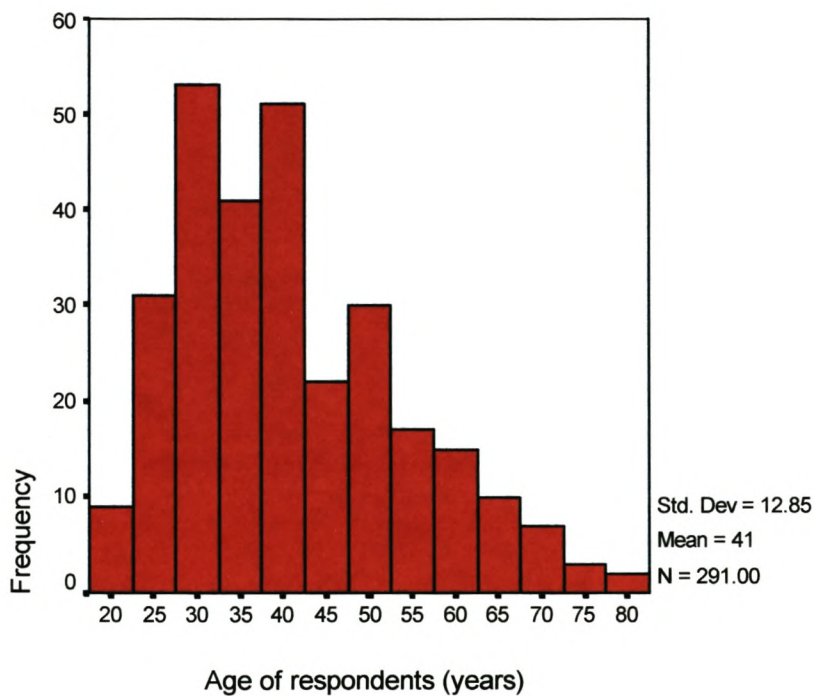


Figure 4: Distribution of age among farmers in the study area, Eastern Province, Zambia

Family size varied between households. The number of children ranged between 0 and 28, giving an average of five children per family. Six percent had no children, 68% had six children or less, while 26% had seven or more children.

The extended family system still prevails in Zambia. Of the sampled households in the study area, 54% had extended family members living with them. Some families had up to 16 of such members but on average, each family only had two. Depending on the ages of these members, and also of the ages of the children, they became part of the labour for the family farm plots. Both male and females worked on the farm. The age at which they started helping depended on such factors as family size, wealth status, or whether they were enrolled in school. Labour was sometimes hired, but it was too expensive for most families to afford. They that were unable to hire manual labour, oxen or farm tractor meant farmers were likely to have family members contributing their labour at an earlier age. Child labour, though unreliable, appears to play an important role in the farming systems of the rural areas. In a study done in Kenya, Wambugu (1999) reported that 95% of the respondents acknowledged children's labour in weeding, harvesting and transportation of the produce from the field to either the home or market.

5.1.2. Sources of farmers' income

Table 3 indicates the overall percentage of respondents earning income from a given source, with some farmers having more than one source of income. The livelihood of the sampled households was derived mainly from agriculture. Scarborough *et al.* (1997) confirms that people in rural areas of most developing countries rely on agriculture for their living. Although there were other sources of income, 84% of the population earned income through sale of farm produce such as cotton, groundnuts, maize, sunflower and sweet potatoes. Gardening was another source for 27% of the farmers. This is usually done out of the main farming season for production of various vegetables. These vegetables include onions, rape, tomatoes, cabbages, carrots, green peppers, green beans, and cucumbers.

Table 3: Sources of income for the farmers in the study area, Eastern Province, Zambia

Income source	% of respondents
Sale of farm produce	83.8
Minor resale business	28.4
Gardening	26.7
Piecework	7.1
Beer brewing	6.1
Remittances from children	2.0
Formal employment	1.7

The results in table 3 illustrate that the rural communities in the study area depend on land resources for their income. Their dependency on agriculture would influence them to take up technologies that help them to improve their productivity. Improved fallows could be a major breakthrough for both the seasonal farms and vegetable gardens.

5.1.3. Farm size

Land for cultivation in the rural areas is under the custodian-ship of the chiefs and village headmen, and is obtained mostly through clan lineage. It is divided among family members, with the sizes of the farms varying depending on the family size. As powers over land are vested in the local leaders, they settle any land disputes. According to one chief in Katete, *“deviants to expected land norms could have their land confiscated and given to someone else. Such deviants could even be excommunicated”*.

The mean farm size in the sample is 3.7 ha per farmer. Seventy-three percent of the farmer’s own lands below the sample mean, most of these were females (Figure 5).

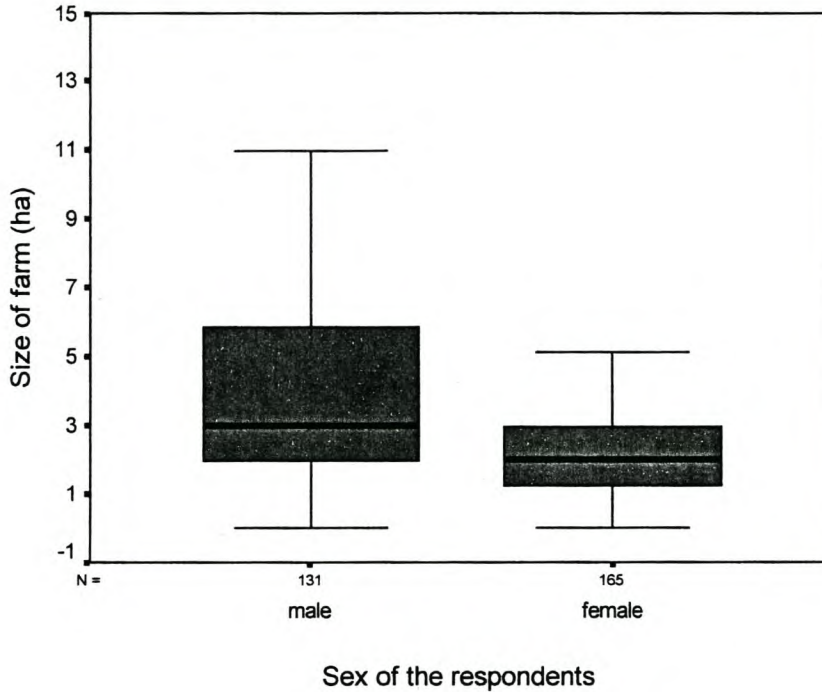


Figure 5: Farm sizes of farmers in the study area, Eastern Province, Zambia

Most farmers depend on hand cultivation and are therefore not able to cultivate more than half a hectare. Thus, some land is left to fallow. There were also exceptional cases where those with smaller pieces of land could fallow their land and then cultivate on borrowed land for a stipulated period of time. This occurred when farmers observed irreversible decreased yields in their own fields.

One percent of the females did not own any land and therefore depended entirely on borrowed land to cultivate their crops. Such farmers were limited with what they could do with this land for fear of the owners claiming it back any time. These farmers were mostly those who had left their villages in the past because they had married in other areas but had returned due to separation, divorce or being widowed. Generally, land for cultivation is not a problem in the study area, although the size discourages some farmers from experimenting with improved fallows.

5.1.4. Agroforestry technology awareness

The improved fallow technology has been experimented with and practised on-farm for over a decade now. In the three districts, 92% of the respondents were aware of the existence of the improved fallow technology. The few that had not heard about it had either recently moved to these villages or just had a negative attitude towards community activities, because even when asked whether they had attended any of the extension activities, their response was negative.

Other organisations, apart from MAFF, involved in dissemination of the improved fallow technology include World Vision International (WVI), Lutheran World Federation (LWF), Reformed Church in Zambia (RCZ), DWDA and the research institution, ICRAF. Farmers' source of initial information on improved fallows cuts across these organisations. Farmer trainers were a source of such information to 41% of the farmers whereas 28% first heard from the government agricultural extension officers (Figure 6). These two results combined are lower than 81.1% obtained by MAFF in their survey in Eastern Province (MAFF, 2000a). Only one percent indicated the radio as their initial source and yet ICRAF had run radio programmes in a local language for some time. Similar results of sources from fellow farmers and radio respectively, were obtained by a survey undertaken by MAFF in 2000 (MAFF, 2000a). When asked about the radio programmes, farmers indicated that they never took information from the radio seriously especially when programmes were presented only once. They found it difficult to follow because they had no chance to ask questions, a disadvantage of one-way communication. Others indicated that they were too busy at the time the programmes were aired, some did not own radios and for others it was a question of not being able to afford the batteries. The farmers that identified ICRAF as their source were mainly those that had been involved with on-farm trials.

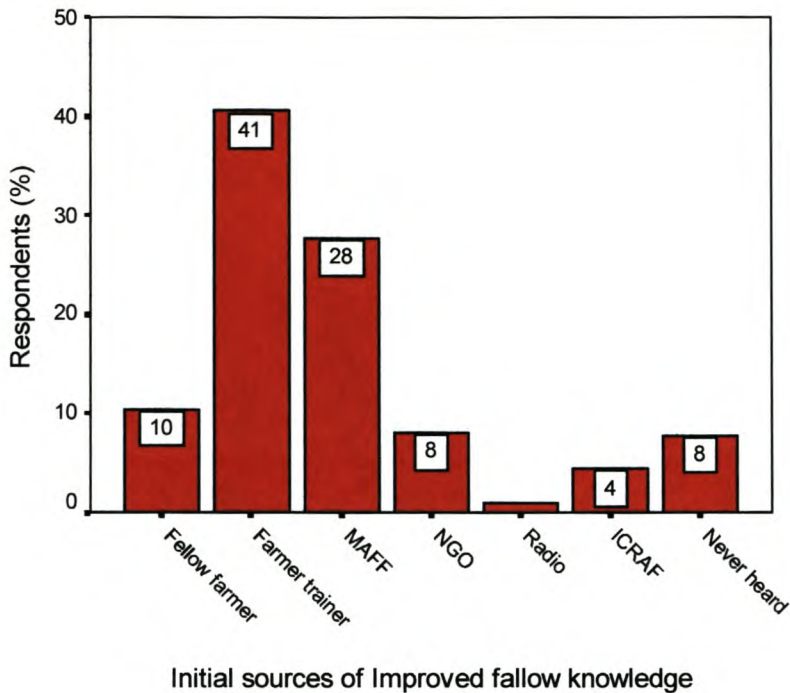


Figure 6: Farmers' initial source of information about improved fallows in the study area, Eastern Province, Zambia

The period within which farmers first heard about improved fallows spans from 1989 to 2000 (Figure 7). Until 1997, only 24% of the farmers had heard about improved fallows. There was a triple increase by the year 1999. This increase could be attributed to the involvement of the farmer trainers in the three districts in 1998 and 1999. The farmer trainers have been engaged in these villages to specifically work on improved fallows with their fellow farmers. The ease with which the trainers have been able to reach more farmers within a short time results from working in their home areas, where they are more aware of the community's problems and needs. Scarborough *et al.* (1997) reports similar experiences in India where farmer extension volunteers found it easy to work in their local communities because they spoke the same language, and were also more aware of the context, strengths and limitations of the communities.

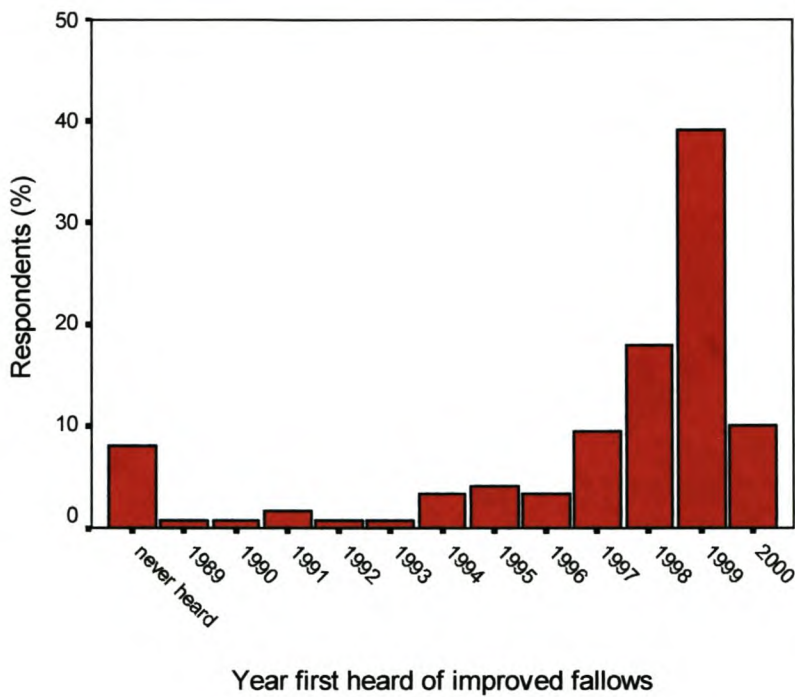


Figure 7: Years when improved fallow technology initially reached farmers in the study area, Eastern Province, Zambia

5.1.5. Improved fallow practice by farmers

Although 92% of the farmers were aware of the improved fallow technology, only 33% had initiated it on their farms. The rate at which farmers try improved fallows has been increasing with time. Nineteen percent of these farmers only started planting improved fallows in 1999. If adoption of an innovation were defined as the decision to apply an innovation and then continue using it (van den Ban and Hawkins, 1988), then less than 10% of farmers in this sample have adopted improved fallows. Most farmers were still in their trial phase, and have still to decide whether or not to continue with it.

The portions of land on which improved fallows were being planted varied from 0.02 ha to 0.835 ha per farmer. Twenty-eight percent of the farmers planted on less than a quarter of a hectare. There is a deliberate move by researchers and extension agents to encourage farmers to plant not less than 0.25 ha if the impact of the improved fallows



Plate 1: Farmer's field cultivated to a food crop with improved fallows of *Sesbania sesban* and *Tephrosia vogelli* in the background



Plate 2: An intercropped field of maize and *Gliricidia sepium*

was to be felt (Mafongoya⁷, pers. comm., 2000). As most farmers were still experimenting with the technique, it was common to find land planted with less than ten rows of the improved fallow species, with expectations even from these smallest of fallows being high. To these farmers, the area they put to fallow did not matter, but they still expected to see an improved harvest as a result, a notion that requires the attention of the extension agents. Farmers need to be educated on the land's productive capacities so that they do not expect bumper harvests from such small areas.

5.1.6. Reasons for not planting improved fallows

Farmers gave various reasons for their not participating in planting improved fallows on their farms. A summary of their feedback is provided in table 4 and explained below. The percentages do not add to 100% because some respondents had more than one reason for not planting improved fallows.

Table 4: Reasons given by farmers for not planting improved fallows in the study area, Eastern Province, Zambia

Reason for not planting	% of the respondents
Lack of seed reason	28.4
Just heard about Improved fallow	19.9
Does not own land/enough land	9.1
Lack of interest	5.1
Illness/old age	3.7
Still with fertile land	2.0
Late seed delivery	1.4
High labour requirement	1.4

Lack of seed emerged as the most common reason for farmers inability to plant improved fallows despite ICRAFs efforts to provide enough seed for farmers via MAFF and farmer trainers. One strategy that was used to supply planting material to farmers was the establishment of group nurseries, especially for species like *Sesbania sesban* and *Gliricidia sepium* that require nursery establishment before they are planted out in the

field. Limited water supplies had encouraged these group nurseries. However, group nursery management has not been easy in that certain farmers do not take responsibility to managing the nursery but are only interested in collecting seedlings when they are ready for transplanting. This frustrated the efforts of the few that were left to manage the nurseries, especially since some of the more responsible members then did not receive adequate numbers of seedlings at the time of distribution. This prompted farmers to opt for individual nurseries so that each farmer took responsibility of his/her own seedlings.

The late delivery of seed also discouraged some farmers from planting species that require nursery establishment rather concentrating on species such as *Tephrosia vogelli* that require direct sowing. *Cajanus cajan* might also have been preferred but its seed has not been readily available. Where it has been available, the plants have been prone to browsing. *Cajanus cajan* is preferred because of its food value as a relish but with a livestock farming system where animals are not herded at certain times of the year, it might remain unpopular to most farmers. Perhaps if by-laws could be improved and reinforced to allow herding of animals throughout the year, then its use might increase.

Some farmers' fields were still fertile enough for them to harvest sufficient food even without applying any fertiliser. The others had land problems, either their land size was too small or they cultivated on borrowed land. Such farmers could not afford to plant fallows or they would not have had anywhere to cultivate their food crops. They preferred continuous cultivation even when their labour investment did not match with the output. They were hesitant to plant trees on borrowed land because if the owners decided to reclaim it, they would reclaim the fallows as well. Extension agents need to infuse the concept of improved fallows in the crop rotation cycle, using species such as *Gliricidia sepium* and *Tephrosia vogelli* which can be inter-cropped with maize and other staple crops, so that farmers would in future see it as part of the normal cycle and not as a time when they leave their land idle.

Four percent of the farmers did not participate in improved fallow technology due either to poor health or old age. While improved fallows have been said to be labour intensive,

⁷ P. Mafongoya, Project Leader, ICRAF, Chipata, Zambia. August, 2000.

few farmers than those reported by the MAFF survey stated labour alone as the reason for their decision not to participate (MAFF, 2000a). Some farmers felt that it required more labour than normal cropping but indicated that this would not stop them from participating when they knew of the benefits they would obtain. Lack of labour was the last reason given for not planting improved fallows.

5.1.7. Improved fallow species

Four improved fallow species have been promoted and planted, namely *Cajanus cajan*, *Gliricidia sepium* (Plate 3), *Sesbania sesban* and *Tephrosia vogelli* (Table 5; Plate 4). Farmers were able to rate the performance of the species they had planted on a five-point scale of very good (1), good (2), fair (3), poor (4) and very poor (5). All the farmers that had planted *Cajanus cajan* felt that it performed fairly well despite its vulnerability to browsing. The few farmers that had harvested some of its seed also experienced problems of storage, because insects destroyed the seed before the next planting season. No similar incidents have been recorded anywhere else. Thus, farmers need advice from specialists on appropriate seed storage methods. Farmers need such information if they are to produce their own seed and not depend on outside sources like ICRAF for supplies.

Table 5: Percentages of farmers planting improved fallow species in the study area, Eastern Province, Zambia

Species planted	% of respondents
<i>Sesbania sesban</i>	20.3
<i>Tephrosia vogelli</i>	28.0
<i>Gliricidia sepium</i>	7.8
<i>Cajanus cajan</i>	2.0

Gliricidia sepium, *Sesbania sesban* and *Tephrosia vogelli* were described by more than 50% of the farmers as having performed well or very well. Most farmers favoured *Tephrosia vogelli*, with 91% of those planting it describing its performance as fair, good or very good. Those that described it as poor had experienced fires in their fields. *Tephrosia vogelli* was the most favoured species because it is directly sown in the field,

and has been used as a pesticide. It is however a fish poison and should therefore be introduced with caution in areas where aquaculture is practised.



Plate 3: An improved fallow plot for *Gliricidia sepium*



Plate 4: An improved fallow plot for *Sesbania sesban*

Gliricidia sepium was also gaining popularity among farmers because of its ability to coppice. Farmers believed that it would reduce the pressure to establish a fallow every year since it could coppice and produce good results year after year. However the number of farmers planting it was low because of lack of seed. ICRAF has an orchard for *Gliricidia sepium* but the seed that is produced is not sufficient to meet the demand (Katanga⁸, pers. comm., 2000). An attempt was made once to import this seed from Malawi, but it was too costly. It is hoped that an initiative by the agroforestry team at ICRAF and MAFF in Chipata to establish seed orchards in each district will help alleviate the shortage. The advantage of a coppicing species is that it can be raised from cuttings as well. Hopefully this will also be the case for *Gliricidia sepium* so that more of this species would become available to farmers through the use of both seed and cuttings.

Sesbania sesban performs well in terms of biomass production and increases the yield of the first crop after fallow much more than the other species. Farmers however experience problems with establishing nurseries for this species due to pest attacks on the seedlings, which can kill almost the entire crop. Farmers reported that they have had to spray with chemicals meant for their cotton crop, a solution that they described as expensive due to the high cost of these chemicals. Research is underway to establish solutions to these insect attacks (Mafongoya⁹, pers. comm., 2000). Recently, there were also reports of attacks on leaves and rootstocks of *Tephrosia vogelli*, possibly from nematodes and mealy bugs. Follow-up research and findings on these attacks were not available to be reported in this study. However quick solutions need be found, considering that this is currently the most favoured species for the majority of farmers.

5.1.7.1. Criteria for species selection

All four of the improved fallow species have not always been available to the farmers. Fifty percent of farmers indicated that they have had to plant the species that they had grown because they were the only type available to them, while 21% had to choose from

⁸ R. Katanga, Dissemination Specialist, ICRAF, Chipata, Zambia. August, 2000.

⁹ P. Mafongoya, Project Leader, ICRAF, Chipata, Zambia. August, 2000.

only two species. Twenty-eight percent reported to have opted for a particular species because they had been impressed with its performance elsewhere. The latter group were non-risk takers, only wanting to try what they have seen working, so that if the seed for that particular species was not available, they were not willing to plant a fallow. Farmers who were privileged to choose from two species mostly belonged to a women's group. As seed is distributed through the farmer trainers who are members of these groups, they have given their fellow members priority in obtaining seed over non-members. In 40% of the villages visited, farmers reported that they felt discriminated against during seed distribution.

In general, farmers were ignorant of the procedure to follow in acquiring seed for these tree species. This requires that farmers register their interest to establish a fallow with the extension staff or farmer trainers in good time. Such registers include information on species type and the area of land that a farmer would like to plant. The information is then passed on to ICRAF, and in the case of farmer trainers, through the DWDA office. ICRAF still remains the major source of seed although other organisations such as World Vision International have also recently been involved in sourcing seed on behalf of farmers. ICRAF purchases seed from farmers who have harvested their fallow and then supplies it to other farmers through the pathways described. Seed purchasing is a temporary activity that could come to an end once the current financial support by KEPA (Zambia) is exhausted. *“KEPA is a Finnish acronym for KEHITYSYHTEISTYON PALVELUKESKUS that stands for Service Centre for Development Cooperation. It is an umbrella organisation of Finnish NGOs that are active in development work and concerned about global issues.”*¹⁰ In anticipation of this, seed orchards are being established in all districts of Eastern Province with the hope of obtaining seed from them in future. These seed orchards are an initiative of the agroforestry research unit of the Ministry of Agriculture.

Farmers who have been planting improved fallow species have become self-sufficient in seed especially for *Tephrosia vogelli* and *Sesbania sesban*. However, seed maturity in

¹⁰ <http://www.kepa.fi>

Gliricidia sepium has been a problem for most farmers, and at present they depend entirely on ICRAF for seed of this species.

While some farmers could be self-sufficient in seed harvested from their fallows, the seed buying exercise forces most of them to sell all their seed for monetary gain, leaving none for them to plant in the next season. Such farmers still register with either extension staff or farmer trainers to obtain more seed to plant, even though this seed may have come from their fields. There is need for extension officers to devise a system whereby they could check that those who sell seed do not re-register for it so as to save on the meagre resources that may be available. Sometimes the extension officers are aware of such people but continue to register them because their superior's evaluation of their own performance is based on numbers of farmers reached in a year and not whether these are new farmers or not.

The seed buying exercise done by ICRAF and WVI motivates some farmers to consider planting an improved fallow for themselves. The monetary incentive for doing so might distort the intended objectives of improving the productivity of land, as well as improving food security. Farmers should be made aware that this incentive is temporary considering that it will only last as long as the NGOs support it. Soon, seed might become abundant and farmers will be expected to acquire their own seed. Perhaps seed loans would be more appropriate as farmers who receive seed could be asked to pay back the same amount of seed so that it can be made available to others.

Farmers need to be encouraged to multiply seed for themselves rather than to depend on outside supplies. For them to be able to do that, extension officers need to include aspects of planning and management in their lessons. Therefore extension personnel must constantly undertake refresher courses to keep up with farmers needs.

Farmers are concerned that they have to plant improved fallow species, which have no food value. They felt that more land would have been put to fallow had these trees had any food value. Unfortunately that is not so, but farmers are still encouraged by the incentive of better yields at the end of the fallow cycle. Small-scale farmers require

constant encouragement to be involved in a particular activity, even if it is for their own good. To ensure that farmers take up improved fallows therefore, research should aim at finding alternative species, which have food value.

5.1.7.2. *Additional planted species*

Apart from the improved fallow species discussed above, farmers have attempted to plant other species that could help them meet their food, fuel-wood, and fodder needs. This was done on a very small scale but their involvement in tree planting is a step towards curbing land degradation and deforestation. If tree planting were well coordinated, more farmers would be likely to get involved in planting. Among the species planted were *Psidium* spp. (guavas), *Citrus sinensis* (oranges), *Strychnos cocculoides*, *Uapaca kirkiana*, *Sclerocarya birrea*, *Eucalyptus* spp., *Senna siamea*, *Leucaena leucocephala* and *Acacia crassicarpa*.

5.1.8. **Farmer participation in agroforestry extension**

Dissemination of agroforestry technologies has been part of the government's general agricultural extension system, promoted side by side with other agricultural technologies. Agricultural extension officers based at camp level, under MAFF, have executed these extension tasks. Seventy three percent of the farmers were aware of the agricultural extension services that were provided by the government, and seemingly understood their roles. However, their perceptions of the current services being offered were varied.

Farmers were asked to identify their agricultural extension officers in order to establish if there was any interaction between them. Seventy percent were able to identify them, 23% did not know them by name while 7% indicated that there was no one working in their area. The latter cases were common in areas where the camp had no officer. In all cases but one, officers named were from MAFF. The only other case was from LWF, an NGO also involved with dissemination of improved fallows. While farmer trainers operated from these areas, none of the farmers identified them as their extension agents, although they were aware that they also promoted improved fallows. As far as local

leaders were concerned, only in rare circumstances did these farmers see them as extensionists.

5.1.8.1. Agroforestry extension methods

Four extension methods have been used to disseminate the improved fallow technology to the farmers, which include meetings (Plate 5), courses, field demonstrations and farmer field days. The participation of farmers in the activities has been relatively low, although it has been improving with time. From the sample, 2% attended meetings in 1995, with an increase to 25% in the year 2000. Farmers attending field days also increased from 2% in 1995 to 18% in the year 2000. The increase in participation in courses and demonstration has been very low however. Course participation has increased from 1% in 1995 to 8% in 2000, while that for demonstrations increased from 1% in 1995 to 6% in 2000. According to this study, 75% of the farmers have not participated in any of the extension activities that have been organised. Considering that 92% of the farmers were reportedly aware of improved fallows, it can be assumed that farmer-to-farmer extension or individual extension methods have been used to reach more farmers. Individual methods are good but expensive on a large scale.



Plate 5: Farmers attending an agroforestry meeting

5.1.8.2. Reasons for not participating in extension

Farmers who have not participated in the extension activities advanced various reasons for not doing so. For 57% of them, it was lack of knowledge of events organised while 20% indicated that these activities always coincided with their being engaged in other activities. Other reasons given included farmer's lack of interest, poor health, laziness, and for some farmers it was because they had only recently moved to these areas. The distance to places where these activities were organised also discouraged a few farmers, some of them were requiring motorised transport to reach. In such cases, farmers organised themselves and only sent representatives to attend. The reporting back system by these farmers who were mandated to attend was not discussed but there appeared to be no formalised reporting system. In most cases however, extension activities were organised within walking distance for most of the farmers, with 86% of the farmers indicating that they could walk to the centres where extension activities were organised. The time it took them to walk to these centres varied between five minutes and one hour.

Farmer participation in extension activities is crucial for both the diffusion and adoption of agroforestry technologies. Farmers learn more from what they see than what they are told (Pretty, 1995). Activities therefore should include both those that aim to theoretically teach and those that allow farmers to practice what they have learnt. Farmers need to participate in planning and implementing these activities so that they would feel part of the organisation and make sure they attended. There is a tendency by extension agents to organise such activities only to their convenience and only announcing to the farmers when they should attend. The result is that most farmers do not know about the activities and hence do not attend. Poor attendance in such circumstances is often attributed to farmers' lack of interest when in reality it was lack of information. Therefore, monitoring and evaluation of these activities should be enhanced to improve efficiency.

Farmers also identified other agricultural technologies that the extension agents have taught to them often, citing more than one each. These included conservation farming (27%); fruit production (11%); livestock management (<3%); uses of animal manures

(20%); aquaculture (<2%); and processing, storage and marketing of agricultural produce (<2%).

5.1.8.3. Farmer-extension agent visits

Only 25% of the farmers were aware that they could initiate a visit to their agricultural extension officers. The other 75% thought that they could only interact with these officers during organised extension activities. There is no forum for farmers to discuss their farm experiences as discussions during extension activities are restricted to the topic of the day, and yet farmer discussions can widen the scope on which extension messages are based. Farmers often felt that they learnt nothing new hence their reluctance in attending such activities. To ensure full farmer participation, the learning approach and not teaching approach should be adopted (Pretty, 1995).

Extension officers are supposed to plan visits to all farmers in their districts and yet 46% of farmers indicated that they had never seen the extension officers in their villages (Table 6). Thirty-five percent had a visit at least once a month, however, which suggests that extension officers are not sharing their time equally among farmers. Farmers were concerned that visits were often targeted at farmer's or women's groups, so that those farmers who belonged to neither of these groups were left out of all agricultural discussions. Most could not recall when they last had had a general meeting concerning agriculture.

Table 6: Frequency of farmer visits by agricultural extension officers in the study, Eastern Province, Zambia

Frequency of visits	Respondents (%)
Twice a month	10.1
Once a month	12.2
4 times a month	12.8
Rare	18.9
Never	45.9
Total	100.0

The criteria for membership of these groups varied from place to place. Some required payment of a fee, while others were open to anyone as long as they were willing to abide by the operational rules. In some cases, the membership fee was set high above most farmers' annual income, and therefore excluded them. This was common to groups that over time had acquired facilities that provided them with stable incomes. One such example was a women's group in Kasosa village in Chipata District that owned a hammer-mill.

5.1.9. Farmers' perceptions of the agricultural extension service

Seventy-five percent of farmers were not satisfied with the service offered. They felt that they still lacked information on how to best manage their farms because they did not have enough contact with the extension officers, and thought officers needed to organise more meetings, courses, and field days. They believed that taking part in these activities gave improved farm output, as was evident from some farmers who had regularly participated and contacted with extension officers.

In some areas, farmers requested the government to send them an agricultural officer because their areas had been left unattended for some time, and extension activities were rare. It is in these areas that farmer trainers' efforts have been highly appreciated. Other camps, though manned, were as good as empty because officers did not have an impact on farming activities. Farmers felt the need for officers to be closely and regularly supervised if they were to have an impact on improving farmers' livelihood. However, field supervision of extension officers has not been feasible to date due to lack of resources.

While farmers' perceptions of the agricultural officers appeared to be negative, the conditions under which these officers operate leave much to be desired. They suffer from lack of resources and support, and are therefore de-motivated. Reporting has become more of a routine task than addressing issues emanating from their work. It is in the area of resource provision that NGOs could collaborate with the extension service in order to scale-up adoption of improved fallows.

Farmers felt that increased visits would influence their participation in extension activities. However, as Mitti *et al.* (1997) observe, frequent farmer visits can be expensive and were partly the reason the 'training and visit' system, where regular visits are made to individual farmers, has not been successful in most African countries. The resources to ensure this task is done have not been available. Working groups therefore become useful in that they reduce individual visits, hence the need for farmers to join at least one group.

Group formation should not be the extension agents' responsibility but only a means for them to reach more farmers at once with fewer resources. Usually, outside intervention into local groups weakens the institution (Pretty, 1995). Farmers should therefore be responsible for forming such groups so that even when no support from outside is offered they could be encouraged to continue on their own with such activities. Organised groups feel responsible and committed to work (Pretty, 1995). Therefore, to develop a strong foundation on which technologies are disseminated, such groups should be encouraged.

Women's groups exist in all areas where this study was undertaken, with their membership comprised mostly of women. Male membership of less than 5% of the total membership was common in some areas. The low male percentage was as a result of the initial objective of these groups, which were meant to teach women home economics. Recently however, all development aspects have been covered including health, sanitation, water, education, and child-welfare. The women's groups appear to be well-organised local institutions through which most NGOs have reached to the local people. They are a source for the majority of the farmer trainers as well.

Farmers requested extension officers to give them better advice on available loan facilities. They blamed extension officers for the losses incurred in servicing their previous loans to lending institutions, where some have had to pay back all their produce because even the extension officers did not fully understand the pay back conditions for the loans. Farmers also felt the need for extension officers to be fully involved with distribution of improved fallow species seed to ensure that more farmers accessed it.

Farmers' involvement in planning and execution of extension activities would enable them to understand the difficulties that extension officers' experience. The challenge for the extension officers is to ensure full participation of farmers at every stage of extension. If farmers are the reason for which extension is planned and executed, their participation in programme activities is essential if extension should have impact on their livelihoods.

5.2. Agricultural extension officers

5.2.1. General overview of the sample

A total of 14 extension officers were interviewed, of whom 86% were males and 14% females (Table 7).

Table 7: Distribution of the sample of agricultural extension officers in the study area, Eastern Province, Zambia

District	Sex of the respondents		Total
	Male (%)	Female (%)	
Chadiza	21.4	14.3	35.7
Chipata	42.9	0	42.9
Katete	21.4	0	21.4
Total	85.7	14.3	100.0

The agricultural extension officers are employees of the government under MAFF. Before they are employed as extension officers, they undergo technical training for either three or two years at agricultural colleges where they are awarded either diplomas or certificates upon completion. They operate in areas whose size is predetermined by MAFF, and not on number of households in it, hence there is a disparity in the sizes of target groups. The target groups ranged from 70 households per officer to over 6000 households the more densely populated an area, the more households under ones jurisdiction. Extension officers are employed till the age of 55 years at which they are expected to retire. Their ages ranged between 20 and 54 years. The medium of communication was the farmer's local languages. Both extension officers and the farmers indicated that there was no barrier in communication.

5.2.2. Mobility

Extension work requires the extensionists to travel to areas where their service is needed. Each extension officer is expected to cover a large area and yet the most common means of transport was a bicycle (57%), which restricts the area covered (Figure 8). Even when these bicycles were provided, officers lacked spares and as a result, they had to walk to their areas of operation.

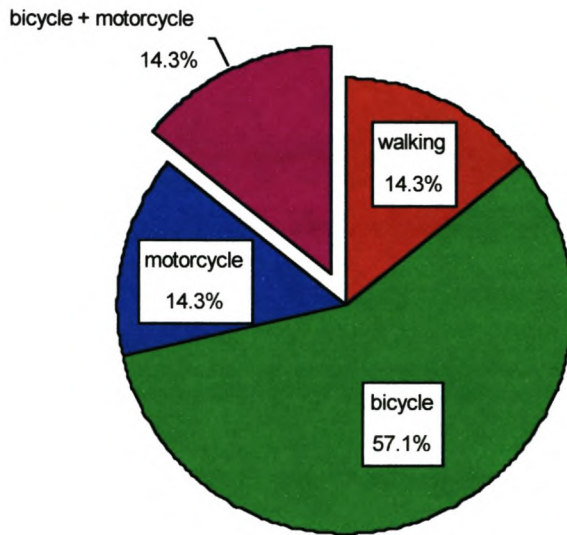


Figure 8: Agricultural extension officers' form of mobility in the study area, Eastern Province, Zambia

For those privileged with motorcycles (14%), fuel is inadequate. In circumstances where NGOs have sought the services of these officers, they have had to provide the fuel as well as other allowances. There were however some of the officers who had no means of

transport but entirely depended on walking to do their work (14%). Although regular visits are planned at the start of the year, they are not accomplished due to poor mobility and lack of resources.

Farmer visits planned by the agricultural extension officers varied depending on the size of the target group. They ranged from once a week (7%), fortnightly (71%), once a month (14%) and others not having a scheduled visit plan (7%). All the agricultural extension officers indicated that they attempted every year to reach all the farmers in their camps, though with difficulty. Rarely did they manage to undertake their visits as scheduled. This confirms some farmers' feedback in Section 5.1.8.3 where they indicated that they had rarely or never seen their camp agricultural officers.

5.2.3. Extension methods used

The main technologies that were identified by the extension officers as being disseminated to the farmers were improved fallows, conservation farming, and use of manure and compost for fertility improvement. A combination of extension methods has been used to disseminate these technologies. Apart from those methods identified by farmers in Section 5.1.8.1, extension officers also used distribution of leaflets; field visits of individual farmers, tours, and workshops to reach their clients.



Plate 6: A visit to a farmer's field by agroforestry partners

5.2.4. Constraints faced by extension officers

Extension officers have not been able to reach their set targets at any time, with 93% indicating that they wished to reach more farmers than they did currently. There were many constraints that these officers faced in their daily operations as shown in Table 8 and summarised below.

Table 8: Constraints faced by agricultural extension officers in the study area, Eastern Province, Zambia

Constraints	% of respondents
Mode/lack of transport	92.9
Inadequate resources	35.7
Lack of incentives	35.7
Lack of seed to distribute to farmers	21.4
No protective clothing	14.3
Trampling by livestock	14.3
Large area coverage	14.3
Poor collaboration among stakeholders	7.1
Lack of teaching aids	7.1
Political interference	7.1
Inadequate training	7.1
Lack of support from local institutions	7.1
Farmers limited land	7.1

Inadequate transport

The problem of inadequate transport is related to distances that are covered by the officers. If transport issues cannot be addressed, it is necessary to re-consider the area that each of the officers covers, based on the means of transport they are provided with. Extension officers have been accused of not achieving their objectives without due consideration of the resources made available to them. Performance of agricultural extension officers should be measured in relation to resource input. Many times, these officers have closely worked with NGOs operating within the same areas where they have performed well. Mitti *et al.* (1997) provided a good example of this when they compared performance of government extension officers with those of Care International in the Southern Province of Zambia. They found that the officers employed by Care International were once employees of the system that has failed to produce results. The backbone of result-oriented NGOs is the immediate availability of required resources and good conditions of service (Pretty, 1995). Perhaps if resources were made available to the extension officers in the manner that they were available for NGOs, their output would increase to match with the input.

The government of Zambia has generally failed to fund service departments fully and could be responsible for failure by the agricultural extension services to meet their

objectives. It has authorised NGOs to work in some areas although the conditions under which these NGOs operated were not made known to the professional authorities in the Provinces. Some NGOs already provided support in terms of incentives (allowances) and mobility of extension officer but it was still done haphazardly. Clearly written agreements are required so that each party is aware of their contribution when activities are arranged.

Lack of resources

Agricultural extension officers lacked resources to enable them carry out their duties. These resources were in many forms such as transport, spare parts, stationery, teaching aids, fuel (in case of those using motorcycles), and finances.

MAFF provided the majority of resources for the day-to-day activities but according to 93% of the respondents, these were not sufficient for the required purposes. As a result, other organisations have aided the government by providing different types of financial and physical resources for extension activities, as well as capacity building (Table 9).

Table 9: Sources of resources for agricultural extension officers in the study area, Eastern Province, Zambia

Source of resource	Type of resource
ICRAF	Seeds, seedlings, training, finance for demonstration and field days
WV-IAP	Seeds, allowances, protective clothing, bicycle spares, transport for farmers' tours, finances, fuel, training
MAFF	Transport for officers, spare parts, allowances, seeds, fuel, training
LWF	Seed

Such organisations include ICRAF, WV-IAP (World Vision-Integrated Agroforestry Project) and LWF. Financial support has been in form of allowances (lunch allowance for whole-day activities) and purchase of necessary resources to conduct these activities.

Physical resources include seed, seedlings, bicycle spare parts, fuel, protective clothing and sometimes transport for farmers' tours. Capacity building involves training to enhance technical knowledge base of both extension officers and farmers.

While teaching aids and stationery are necessities for conducting extension activities, no effort had been made to acquire them due to limited government funds. There were however farmer-training centres at district level where some of these facilities were available. Though not comprehensive, the centres provided basic facilities for meetings and courses. Facilities that were most scarce were those useful for mobile courses or meetings. Audio-visual equipment would also have been useful to capture events so that they could be shown to other farmers who are not able to attend such gatherings.

Lack of incentives

The issue of incentives for extension officers is crucial to their willingness to participate in extension activities organised by other organisations. The low salaries for government officers are likely to influence their output in that they may prioritise providing for their families needs and only participate where there is an added financial incentive. If they were well remunerated and had access to other incentives, they would be motivated to work, as demonstrated by those who have joined the NGOs. As elsewhere, NGOs in Zambia have become a brain drain for government, as increasingly they are able to attract skilled people away from the public sector (Pretty, 1995).

Lack of seed to distribute to the farmers

Although the agricultural extension officers were mandated with seed distribution, they did not receive enough from MAFF and researchers to meet farmer demands. This had a trickle-down effect to the farmers as was discussed in section 5.1.6 where farmers identified lack of seed as one of the reasons for their not planting improved fallows.

Lack of protective clothing

Extension officers are expected to attend extension activities on schedule regardless of the weather. Often they have not been provided with protective clothing of any kind. Their requests for these items have remained unattended, and the officers are unable to purchase them for themselves due to meagre salaries. Consideration should be made for provision of these protective clothes so as not to subject the officers to harsh working conditions and also to encourage them to be available for extension work despite the weather.

Trampling by animals

The free grazing system that is practised in the study area during the dry season raised concern to the agricultural extension officers. Although farmers did not report this as the reason for their not planting improved fallows, it was felt that trampling would increase with increased planting. There were isolated cases of trampling though on very small scale.

Large area coverage

The areas that the agricultural extension officers were assigned to cover for their extension work did not match with the resources provided. The inability to reach all the farmers was exacerbated by poor transport and lack of incentives, as discussed above.

Poor collaboration among stakeholders

Considering that there are many organisations involved with disseminating improved fallows, the need to collaborate arises because they are all dealing with the same group of farmers. Agricultural camp officers felt that there was no collaboration among these organisations. Programmes for one group are organised without the consent of the others, and sometimes these activities take place at the same time, forcing farmers to

make choices over which ones to attend. If farmers are to benefit from the development projects that organisations undertake on their behalf, the organisers need to plan together to ensure full farmer participation. With well-collaborated activities, organisations stand to save some of their resources or at least use them to reach more farmers. The role of the government extension officer needs to be streamlined, to possibly take the role of a facilitator rather than that of a competitor.

Political interference

The politician's interests may conflict with those of agricultural extension. Politicians have often capitalised on farmers' desperate need for fertiliser to boost crop productivity. They are aware that most small-scale farmers are unable to afford fertilisers and therefore use it as a campaign strategy to win votes from farmers. Often farmers are promised free or cheaper bags of fertiliser. Recently, poor rural communities were being promised fertiliser under the poverty alleviation programme, and agricultural extension officers were middlemen in this exercise. Usually such politically motivated programmes do not succeed, and with the involvement of the agricultural personnel, their failure would be identified with them. Consequently, agriculture extension work suffers.

Additionally, promotion of subsidised fertiliser conflicts with that of improved fallows. If farmers could afford fertiliser, it is likely that they would reconsider their involvement with improved fallows especially because they do not fully understand the added benefits of organic fertilisers. Such conflicts could be ironed out through sensitising politicians of the technology's benefits. Apart from extension messages explaining the process of establishing improved fallows, they should be diversified to include environmental aspects, farm planning and basic record keeping.

Inadequate training

Some officers felt the need to be retrained in certain aspects if they were to disseminate the technologies effectively. Some of them were not confident in that they had not had any other training apart from what they had at college. In general, the college curricula

do not keep abreast of agroforestry innovations in the field, hence to need for officers to be re-trained on regular basis.

The technologies that are disseminated the most were those for which extensionists received funding and which government mandated. For example, conservation farming was disseminated because the government agreed with sponsors that they would promote it as a soil fertility initiative. Yet no proof that it could work on farmer's fields in Zambia existed apart from knowledge that it worked somewhere in Zimbabwe (Lungu¹¹, pers. comm., 2000). While improved fallow technology has been experimented with and used for almost a decade now, at no time has the government had a deliberate promotional programme for it. This technology would help farmers to improve their welfare but if it is to have impact, government should put in place a deliberate plan to promote it. Agricultural officers felt that financial resources were required to support extension activities such as meetings, mobile courses and field days to enhance farmers' perception of the technology. These resources would also enable officers in higher offices to verify the reports that are sent to their offices by allowing them to physically visit the fields of operation.

Lack of support from local institutions

Extension officers also felt that they did not receive enough support from the local traditional leaders. The success of extension work depends heavily on the cooperation received from local leaders. Agricultural officers have lost popularity among local leaders because of their not having lived up to their promises before. Local leaders are also farmers that require extension services as much as the people they lead, and they share the same sentiments about the extension officers as do their people. Some local leaders felt that officers were not putting enough effort because they operated in areas, which were not their original homes and as such were not very concerned with the outcome of their work. This perception needs to be addressed for the purpose of scaling up improved fallows. The suggestion made earlier of involving the community at all

¹¹ J. P. Lungu, Deputy Director, Department of Field Services, Ministry of Agriculture, Food and Fisheries. August, 2000.

stages of extension would assist in addressing this problem since local institutions constitute local community members. Communities would stop being suspicious of the extension officers if they were to participate in decision-making. The nature and level of participation also matters. To ensure that participation is result orientation, then “*the functional, interactive or self-mobilization*” types of participation (Pretty, 1995:172-4) could be advocated for (Table 10 refers).

Table 10: A typology of participation

Typology	Characteristics of each type
Passive participation	People participate by being told by an administration or project management what is going to happen or has already happened
Participation in information giving	People participate by answering questions posed by researchers using questionnaire surveys or similar approaches, but do not have the opportunity to influence proceedings. The findings of the research are not shared with the participants or checked for accuracy by them.
Participation by consultation	People participate by being consulted on their views. External professionals define both problems and solutions, and may (but are not obliged to) modify these in the light of people’s responses. However, local people do not share in decision-making.
Participation by material incentives	People participate by providing resources- for example labour, or land – in return for food, cash or other material incentives. Much on-farm research falls into this category, as farmers provide the location but are not involved in the experimentation or the process of learning. It is very common to see this called participation, yet people have no stake in prolonging activities when the incentives end.
Functional participation	People participate by forming groups to meet predetermined objectives related to the project, which can involve the development or promotion of externally initiated social organization. Such involvement tends to come after major decisions have been made, rather than during the planning stage.
Interactive participation	People participate in joint analysis, which leads to action plans and the formation of new local institutions or the strengthening of existing ones. It tends to involve interdisciplinary methodologies that seek multiple perspectives and make use of systematic and structured learning processes. These groups have control over local decisions, and so people have a stake in maintaining structures or practices.
Self-mobilization	People participate by using initiatives independent of external institutions to change systems. They develop contacts with external institutions for resources and technical advice they need, but retain control over how resources are used. Such self-initiated mobilization and collective action may or may not challenge existing inequitable distributions of wealth and power.

Source: Pretty (1995).

5.2.5. Factors affecting adoption of improved fallows

The improved fallow technology has been practised on farmers' fields since experimentation started a decade ago, and yet the adoption rate has remained relatively low. Although most of the farmers were testing it on their farms, this study found that only 10% have adopted the technology, a percentage much lower than was found by a study done by MAFF (MAFF, 2000a). The variations in results could be as a result of differences in the definition of adoption. The reasons given for the low rate of adoption of improved fallows in Eastern Zambia as identified by the agricultural extension officers are outlined in table 11 below.

Table 11: Reasons for low adoption rates of improved fallows according to agricultural extension officers, in the study area, Eastern Province, Zambia

Reason for low adoption rate	% of respondents
Land limitation	64.3
Impatience to wait and maintain a fallow	57.1
Inadequate seed	42.9
Uncontrolled grazing	42.9
High labour requirement	35.7
Traditional land tenure favouring men	35.7
Damage by bush fires	28.6
Pest attack	21.4

Agricultural extension officers identified land limitation as the most limiting factor to low rate of uptake for improved fallows, but this contradicts the farmers who said that land was not the restricting factor. Instead they prioritised seed availability and the period of fallow. However, these reasons need to be carefully analysed so that farmers who are faced with them can be assisted accordingly.

Impatience to wait and maintain a fallow was the next important point identified by extension officers as a barrier of entry to improved fallows for farmers. Although farmers did not identify this as a barrier, the extension officers who have been working with them felt that farmers get discouraged to start improved fallows because they have to wait for two years before they can see the benefits. Although it is possible to

incorporate fallows in a cropping cycle, farmers are restricted by the amount of land that they own. Policy makers who could ensure that they put in place incentives for farmers who are willing to undertake the technology could however address this barrier. One such incentive would be provision of loans that would enable farmers to survive in the initial year of establishing improved fallows, that which would act as compensation for forgone production and/or revenue. This is only possible if government recognised improved fallows as a useful technology towards improvement of food security and people's livelihood.

Inadequate seed is the problem recognised by all stakeholders in the promotion of improved fallows. Apparently, this problem has been realised and is receiving attention (as discussed in 5.1.7.1). Some farmers are actively participating in producing seed although precautions need to be taken to maintain genetic diversity to forestall pests and diseases.

Although 43% extension officers saw uncontrolled grazing as a barrier, it did not seem a problem yet with farmers as it was only experienced on small scale. It is however a matter to take precautions for because the community practices livestock agriculture, which involves free grazing during the dry season.

The traditional land tenure system in the study area favoured ownership of land by men. Women mostly get a share from their male relatives or if they got married then they cultivate on their husband's pieces of land. This restricts the decisions that women have to make as regards participation in improved fallows. This study however found that only 1% of the female farmers had experienced land problems (as discussed in section 5.1.3).

5.3. Farmer trainers

5.3.1. Overview of the farmer trainers

Of the 51 farmer trainers interviewed, 82% were females and 18% were males (Table 12).

Table 12: Distribution of the farmer trainers in the study area, Eastern Province, Zambia

District	Gender of respondent		Total (%)
	Male (%)	Female (%)	
Chadiza	2.0	33.3	35.3
Chipata	5.9	21.6	27.5
Katete	9.8	27.5	37.3
Total (%)	17.6	82.4	100.0

Gender representation was biased to the female because most trainers were recruited through the DWDA, which is dominated by women. Their ages varied between 21 and 60 years, with 61% being below the age of 40 years. Sixteen percent were single, 77% who married, 2% divorced and the other 3% were widowed. The male farmer trainers were all married.

All the trainers had attended school but the highest level of education attained varied (Figure 9). The majority of the farmer trainers attended up to the junior secondary school. Despite their differences in education levels attained, all farmer trainers were able to read and write.

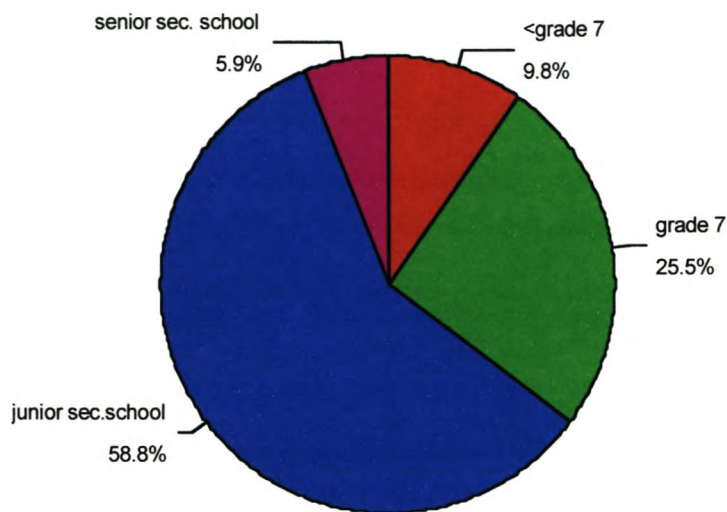


Figure 9: Highest levels of education attained by farmer trainers in the study area, Eastern Province, Zambia

The family sizes of the farmer trainers were not very different from those of the farmers interviewed since they were drawn from the same communities. The farm sizes for the trainers varied, with 61% of them owning even less than five hectares each.

5.3.2. Sources of income for farmer trainers

The major source of income for 88% of the farmer trainers was, like most farmers, the sale of farm produce. They also had other sources of income such as gardening, small resale businesses, informal employment and beer brewing (Table 13). The percentages are not cumulative since some trainers had more than one source of income.

Table 13: Sources of income for the farmer trainers in the study area, Eastern Province, Zambia

Income source	% of respondents
Sale of farm produce	88.2
Small resale businesses	47.1
Gardening	15.7
Piece work	9.8
Beer brewing	5.9

5.3.3. Farmer trainers' participation of improved fallows

All the trainers had planted improved fallows on their farms although their experience of fallows varied, ranging from one to nine years. Seventy seven percent of the trainers had planted their first improved fallow after they were selected to work as trainers; 12% had gone over one fallow period and enjoyed their first crop harvest after the fallow, while the other 11% had experienced more than one crop harvest and had established new fallows more than once.

The species that they had planted were the same ones planted by farmers namely *Cajanus cajan*, *Gliricidia sepium*, *Sesbania sesban* and *Tephrosia vogelli* (Table 14). The majority of the farmer trainers had planted *Tephrosia vogelli*. The percentage of trainers that planted *Cajanus cajan* was almost five times higher than that for the farmers. *Tephrosia vogelli* still remained popular even among the farmer trainers. The percentage of trainers planting *Gliricidia sepium* was higher than for the farmers possibly because the trainers had easier access to the seed than the farmers. Planting *Sesbania sesban* was also higher despite the reported attacks by beetles and nematodes.

Table 14: Improved fallow species planted by farmer trainers in the study area, Eastern Province, Zambia

Species planted	% of respondents
<i>Cajanus cajan</i>	23.5
<i>Sesbania sesban</i>	64.7
<i>Gliricidia sepium</i>	70.6
<i>Tephrosia vogelli</i>	92.2

5.3.4. Recruitment of farmer trainers

Thirty-one percent of the farmer trainers were recruited in 1998 while the other 69% were recruited in 1999. Their work as trainers started immediately after undergoing a weeklong course on basic elements of agroforestry. All trainers but one had undertaken this course, whose purpose was to enhance the farmer's knowledge base on improved fallows practice so that they could effectively teach others. Of these trainers, 86% were recruited through the DWDA via their AWDAs, while the remaining 14% were collectively selected by MAFF and ICRAF.

The criteria on which the AWDA had selected their representatives were not clear as they only indicated that representatives were chosen if they were willing to represent their area in agroforestry. The selection was however restricted to club members, and especially those who were willing to undertake regular visits to attend meetings and workshops. The ones who were collectively selected by MAFF and ICRAF were those farmers who had been practising improved fallows and had even enjoyed the benefits of the fallows. They were hard working and managed their fallows effectively. Their experiences can be used as examples to other interested farmers.

5.3.5. Extension methods used

Similar methods to those used by agricultural extension officers were used by the trainers namely, meetings, courses, demonstrations and field days. Meetings were the most popular method used by 96% of the trainers, followed by courses (82%), then demonstrations (55%) and lastly field days (47%). These activities were conducted in collaboration with agricultural extension officers and researchers. The magnitude of the collaborative activities could not be established due to inconclusive record keeping. There were however some activities that were solely organised by the trainers.

The extension service is free to all the farmers but financial support is required to organise activities that help disseminate agroforestry more quickly. As for funds used particularly in disseminating agroforestry technologies, DWDA has been supported by KEPA (Zambia). The funds were disbursed by ICRAF on behalf of KEPA. Eighty percent of the farmer trainers indicated that they received assistance from these funds while 6% received support from MAFF. There were some activities that were conducted at no cost by 14% of the trainers. It could not be established how much was spent on these activities but the expenses were mainly for provision of stationery, transport and food for the farmers in case activities went beyond lunchtime. Farmers also contributed towards their meals for example, through provision of maize meal while the sponsors provided relish.

5.3.6. Frequency of farmer visits by farmer trainers

Farmer trainers did not have a planned schedule for visiting the farmers but appeared 'on duty' at all times. Most of them organised the activities when convenient for themselves as well as for the other farmers. Because farmer trainers are part of the community, they are able to schedule visits at appropriate times for farmers. Examples, drawn from Latin America and some parts of Southeast Asia, by Scarborough *et al.* (1997) also found that farmer extensionists had the advantage of availability over professional extensionists.

5.3.7. Constraints faced by farmer trainers

Although farmer trainers have only existed for slightly over two years, the constraints that they have encountered in their work compare with those of the agricultural extension officers. They are described below and summarised in Table 15.

Table 15: Constraints faced by farmer trainers in the study area, Eastern Province, Zambia

Constraints	% of respondents
Poor/lack mobility	82.4
Large area coverage	43.1
Lack of protective clothes	21.6
Little/no seed	19.6
Lack of incentives/allowance	17.6
Poor attitude to tree planting	17.6
Poor species performance/pest attack	15.7
Late delivery of seed	11.8
Lack of resources (spare parts, stationery)	11.8
Non-acceptability of technology	7.8
Time consuming (no time for own farm)	7.8
Small size of farmer fields	3.9
Fires in farmer fields	3.9
Lack of collaboration/co-operation	2.0

Mobility

Farmer trainers depended on either walking or cycling to execute their extension duties. At the time of the interview, less than 20% of the trainers were provided with bicycles, although a plan was underway to purchase more bicycles in future. Eighty percent of the trainers still depended on walking to meet with the farmers regardless of the distance. Some resorted to travelling by public transport at their own expense, if they thought they could not walk the required distance.

The few farmer trainers who had bicycles were already faced with the problem of spare parts. While farmers appreciated the work of farmer trainers, they were not willing to assist them acquire spare parts. They were concerned that farmer trainers not only used these bicycles for agroforestry extension but also to meet other personal needs. Trainers

who owned bicycles but had not experienced the problem of spare parts yet were those that had more than one bicycle. Such trainers were involved with other development projects where they were also given bicycles for use when executing their duties. While farmer trainers were free to become engaged in as many projects as they wished, consideration should be made on how effective they would be to undertake demanding tasks such as agroforestry in combination with the others.

Large area coverage

The large area covered by the farmer trainers has worsened the mobility problem. Initially farmer trainers worked in their villages and immediate surrounding villages but in trying to respond to farmers' calls for the need for improved fallows, trainers have found themselves working with farmers from distant villages. Currently, some farmer trainers managed up to 10 villages each. The larger the area covered the more hours they expect to be away from their homes and the likelihood for them to spend some nights away from their homes. One trainer in Chipata South indicated that she usually had to plan for a night out when she visited some villages because, even if she had a bicycle, the villages were just too far for her to cycle to and from, the same day. During the time that she was away from home, she also needed to have enough money to cover her meal costs.

If farmer trainers continue to cover the same large areas that were covered by agricultural extension officers, they will not be able to reach all farmers. Some of the trainers have already realised that they cannot meet farmers in all the areas and have initiated the recruitment of second-generation trainers who act as representatives (or contact farmers) in some villages. There is need to establish a workable ratio of trainer to farmers to ensure efficiency. Second generation trainers require additional training by technical experts rather than to rely on the training they receive from farmer trainers. Incorporating them in workshops and courses would be a major motivation for their participation.

Seed availability

Sometimes, farmer trainers were not able to obtain the seed of the species that the farmers requested because the available seed was not sufficient. However, 80% did not see it as a constraint because they were supplied seed according to their requests. Some of the trainers caused an artificial shortage of seed either by submitting their requests before recording all the farmers' needs or by not just keeping the records properly. The problem of seed shortage is already receiving enough attention from ICRAF and MAFF. Once farmers start to produce enough seeds from their fields and seed orchards are matured, seeds should become abundant and subsequently available to everyone.

Lack of incentives

Eighteen percent of the farmer trainers wanted to be remunerated for their work. They were calling for the DWDA and ICRAF to work out a package of incentives for them. Farmer trainers believed that remuneration would assist them to meet family needs as well as their own expenses when they worked far from home. Lack of finances made them leave tasks incomplete because they could not afford to stay away from home for a long time without food.

The trainers also requested other incentives such as protective clothing. Although participation in courses and workshops and meetings were not seen as an incentive by some farmer trainers, it appeared to have been a motivating factor in their work. The issue of incentives is critical to the effective contribution of farmer trainers in disseminating improved fallows.

Currently, resources are not available to address these demands but consideration should be made for their provision in future. Since the work is currently donor driven, project proposals need be written which would assist DWDA to source the funds. The only way for the incentives to be sustainable would be, if the community could pay for the service they were receiving. Though this might not sound feasible considering that the benefiting farmers earn less than one US dollar equivalent per day, farmers could make indirect payment by mobilising themselves to assist their trainer with a given task like planting

trees as a gesture of good will. Considering that two different institutions i.e. DWDA and ICRAF/MAFF selected the trainers, logistics should be worked out to allow the benefits to accrue to all farmer trainers.

Tree planting culture

Some farmer trainers (18%) pointed out that farmers (including them) were not acquainted with tree planting. While some of them had planted some fruit trees before, they could not easily accept planting a field out to trees that would not give them returns in terms of food. It was a new culture that most people had to develop. Although 82% did not see it as a problem, the others thought that it influenced improved fallow technology adoption because people had to learn a new technique.

Poor species performance

Coupled with the poor attitude to tree planting was the poor performance of some tree species on farmers' fields. This had mainly been as a result of drought and pest attack. Sixteen percent of the farmer trainers felt that some farmers that attempted to plant out fallows were being challenged by the poor performance of trees. If improved fallows were a farmers' first fallow, s/he might be discouraged to try it again since they might be perceived as a time wasting venture. Once the first fallow failed to establish properly, it meant that a farmer had to wait an extra year until the end of the fallow if they were to replant the following year, hence discouraging some farmers to continue with it. Some fallows failed due to fires, a constraint identified by 4% of the farmer trainers. Arson was suspected in some cases of Chipata South where fires were started deliberately inside the field, destroying almost mature fallows. Mice hunters who used fire to trap the animals, but who did not extinguish it after their hunting, were said to have started some of the fires. Even though the percentage that reported the fire problem appears small, the number of farmers affected was substantial, especially in Chipata South.

Acceptability of technology

Nine percent of the trainers felt that some farmers had not accepted the technology as something that could mitigate land use problems. Such farmers had not even tried the improved fallows, as they strongly believed that use of fertilisers was the only solution. However it is such farmers that require to be exposed to the technology so that they could see the results for themselves. Over time, they might be tempted to experiment with the technology.

Time to attend to their farms

Eight percent of the trainers complained that their work had robbed them of time to concentrate on their own farms. They were concerned that their fields would not perform as well as the fields of the other farmers that they were assisting because of neglect. It appeared that farmer trainers were adopting a one- to -one extension method, which could be very demanding. They often helped farmers individually on their farms instead of organising group demonstrations. Farmer trainers require some training to assist them develop planning skills and to understand techniques that can help them be more efficient in their work.

Sometimes, meeting their yearly targets overshadowed trainers' activities. They might spend most of their time convincing farmers to register their interests simply to meet the demands of DWDA. In the year 2000 for example, each trainer was given a target to reach 75 new farmers. Ideally trainers should be least worried about the numbers that they recruit to participate in this technology and concentrate more on their own fields, which will act as models to other farmers. No matter how many farmers they recruit in a year, if their fields do not perform to expectation, they will set a bad example and their recruitment effort will not match with adoption rates. Apart from providing training in planning, if farmer trainers were remunerated, they could use part of the money to hire labour to assist them with farm work while they performed their tasks as trainers.

Poor collaboration with other stakeholders

The agricultural extension officers also identified collaboration as a problem, with the NGOs being blamed for initiating it. The NGOs that worked with improved fallows were usually considered as competitors instead of complementary extensionists. The financial base from which the various groups of extensionists worked were so varied that the NGOs were seen as using their financial strength to win the favour of the farmers. This action was considered unacceptable as it was thought to be short lived.

In the hope to find solutions to the problem of collaboration, the issue was extensively discussed in a networking workshop that was held in Chipata District in August 2000 involved all the stakeholders for improved fallows. A committee was formed to pursue the issue further, the results of which are forthcoming. Farmer trainers however indicated that they worked closely with the agricultural extension officers in their areas in undertaking their agroforestry extension work. This kind of collaboration is important because it builds the confidence of farmers in the technical knowledge that they might receive from trainers, since the agricultural extension officer would support their efforts thus acting as facilitators as well as specialists.

There were isolated cases during this survey in which farmers tried to ask for confirmation of details that they got from the trainers. This displayed signs of mistrust for some farmer trainers by some of the farmers. Some farmer trainers confirmed that they were faced with rebuke when they worked in their own villages. This was however dependent on how good a farmer the trainer was. The farmers' concern was that they could not have someone who was not successful in agriculture to teach them about farming. This is an important point to consider in the farmer trainer selection process, as confidence that potential trainers have built over time in their own villages would have a great influence on their success.

5.3.9. Farmer trainers' achievements

Within the two years that the trainers had been operating, 80% indicated that they had great achievements, with the other 20% not being able to say exactly what they had achieved. The latter group felt that they would be able to measure their achievements once their farmers had improved their output and adopted the fallows. They believed that farmers' repeated establishment of improved fallows would be a sign of a breakthrough of their work.

The former group did not only look for achievements in future however but considered the knowledge and experience acquired in working with improved fallows as achievements. Additionally, the farmer trainers increased farmer awareness about improved fallows and also increased the area under fallow for some farmers. They themselves were privileged to attend study tours and field days to enhance their understanding of the concept of improved fallows. Some farmer trainers felt that being involved with fallows also encouraged them to establish their own fallows.

5.3.10. Farmer trainers' future plans

Farmer trainers have realised that the success of the improved fallows depends on them. Top on the agenda for 60% of the trainers was therefore to recruit as many farmers as possible so that they could participate in promoting it. They have pledged to continue planting fallows so that they would lead by example. They were concerned with the small portions of farms that were put to fallow especially for farmers in the experimental phase. They therefore planned to increase the sizes of their fallows to the level where the output would be enough to draw the attention of other farmers. They believed that farmers usually emulated what they saw on the ground and had been influenced by the sizes of plots that were previously used by research. The farmer trainers' hope is for farmers to emulate their continuous increase in size of fallows every year, which would eventually improve their livelihoods. Farmer trainers also acknowledged the problem of seed supply faced by some farmers. Ten percent of them planned to establish seed

orchards so that they could also supply seed in the near future, either free or at a fee depending on what situation would prevail at the time of their maturity.

5.4. Local leaders

5.4.1. Overview of the sample of local leaders

Two chiefs and 13 headmen, making a total of 15 local leaders, were interviewed. Of the total sample, 27% were from Chadiza, 33% were from Chipata and 40% from Katete. All the interviewed local leaders were males since there were no female local leaders in the area. The two chiefs, namely Senior Chief Nzamane and Chief Mbangombe were interviewed at a workshop organised for policy makers in Chipata. Not all the local leaders had attended school. From the sample, 27% had not attended school at all, 33% attended school but did not reach grade seven, 13% reached grade seven, 13% attended up to junior secondary school while the last 13% attended up to senior secondary school (Figure 10). The trend is similar to that of farmers where more than 50% have not managed to attend up to an examination grade; that for farmer trainers is different, with 64% having gone up to secondary school (sections 5.1.1 and 5.3.1 refers). The average family size for leaders could not be determined because some of them were not willing to disclose the sizes of their families.

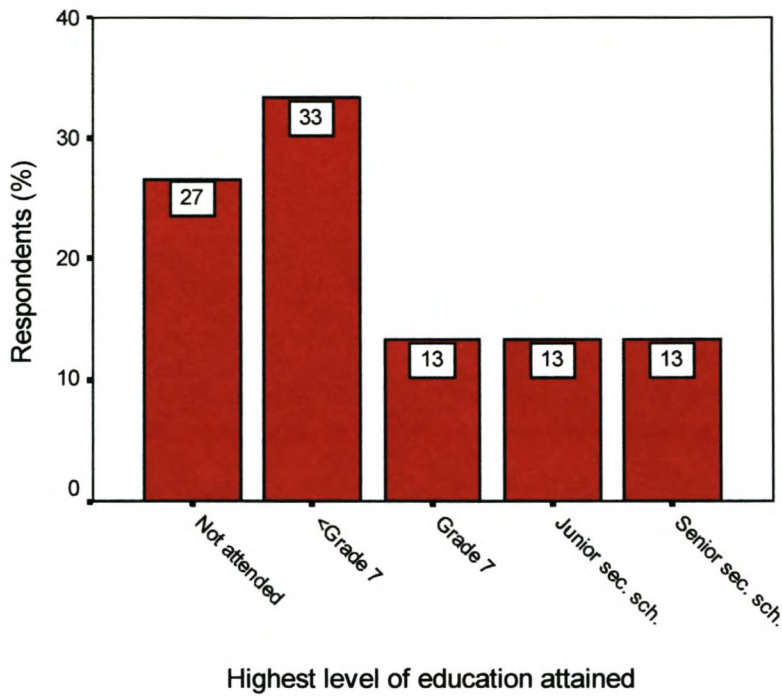


Figure 10: Highest levels of education attained by local leaders in the study area, Eastern Province, Zambia

5.4.2. Improved fallow awareness

Up to 93% of the local leaders had heard about improved fallow technology between 1995 and 1999, with 79% having first known about it in 1998 and 1999. The initial sources of information about improved fallows were farmer trainers, MAFF, NGO (LWF) and lastly ICRAF (Figure 11). Forty seven percent of the local leaders had planted improved fallows on their farms. One chief in Katete even had a demonstration plot established on his farm.

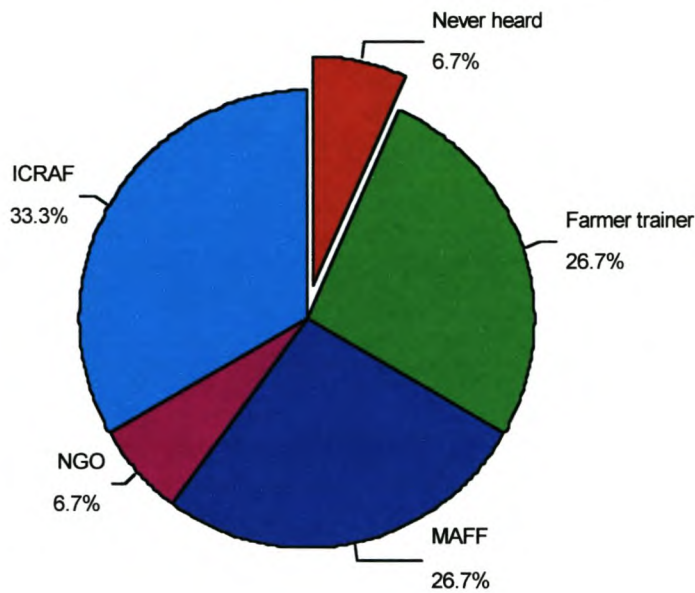


Figure 11: Local leaders' initial source of information about improved fallows in the study area, Eastern Province, Zambia

5.4.3. Participation in extension activities

The local leaders were aware of the four major extension methods that were being used in disseminating improved fallows, and some of them had even participated in them. Meetings were attended by 73% of the leaders. Meetings appeared popular among this group of respondents because they usually took place within the villages. The local leaders were always aware of the meetings because they were the first to be approached by the organisers. Meetings also took less time than the other extension activities, making it convenient for the leaders to attend.

Sometimes, local leaders took advantage of their status to discuss their own issues at these meetings, leaving only a fraction of the time to discuss agroforestry. However the organisers of these meetings could address such problems by planning the meeting

schedule with the local leaders. This supports earlier proposal of including all parties from the planning stage of every activity so those programmes are not jeopardised.

Field days were also attended by 73% of the local leaders, most of whom said that these activities were usually conveniently organised, prompting them to attend more frequently. Only 33% and 27% attended the courses and demonstrations respectively. The frequency at which these activities were conducted and also the distances from the villages to the places where they took place discouraged some local leaders from being present.

Local leaders who had shown enthusiasm in improved fallows were also privileged to attend workshops organised for policy makers at district level so that they could have input into decisions that were finally made regarding implementation of dissemination programmes. Two of the major concerns from farmers engaged in planting improved fallows are that fires and un-herded animals have destroyed their fallows. Considering that the farms are on traditional land, local leaders were thought to be key to help in solving these problems, although it was often said to be difficult to attribute blame once the fallow had been destroyed.

5.4.4. By-laws and the local leaders' influence over farmers

Local leaders have been requested by researchers and extensionists to pass by-laws that would punish people found burning fires and those who left their animals to graze without being herded. In this study, it was established that these by-laws existed but perhaps only required to be reinforced. Sixty percent of the local leaders acknowledged the existence of the laws, but stated that people sometimes ignore these laws.

While local leaders asserted that by-laws existed, 27% were also quick to add that they had not experienced problems of animals grazing or trampling anyone's improved fallow farm. They also added that most of the farmers' fields were far from the villages so that the chances of the animals reaching those places were very slim. While by-laws existed, local leaders felt that they could only be enforced when cases of that sort were reported.

They emphasised that all the villagers were aware of the regulations to which they should abide, and that everyone in the village was responsible for reporting others that they saw acting to the contrary.

However, some farmers had reported such experiences already, though on a very small scale. Problems with trampling are likely to increase with increased planting of improved fallows if the system of free grazing during the dry season continues. During this period, animals are let to feed on the remains of the crop stocks. In such instances local leaders agreed to ensure that they encourage owners of the animals to herd their animals throughout the year so as to avoid animals getting into fields where trees were planted. Zero grazing offers an option too, whereby animals are kept in a stall, and fodder is brought to them instead of allowing them to graze outside. It has been practised in Kenya although it was found to increase both labour and financial investments [IIRR (International Institute of Rural construction), 1998]. Agroforestry research in developing fodder banks would enable the farmers to consider zero grazing since they would have readily available feed for their animals.

Local leaders therefore said they advised farmers to consider growing live fences as an immediate solution to stray animals. They however promised to take to task anyone whose animals were found un-herded, and challenged the villagers to look out for offenders. They also encouraged farmers to regularly visit their fields even during the period when they did not cultivate. When other farmers become aware that regular visits were made to the farms, they would be cautious of where they took their animals to graze.

One headman in Chipata North was concerned with wild fires. He said that his people were usually faced with fires that had been started outside their area. One even blamed the Forestry Department's system of 'control burning' in the natural forest of causing such fires. He claimed that farmers had seen forestry officers burning the fires and in the case where they did not do it on time, farmers went ahead to burn, regardless of the time of year. It appeared that farmers did not understand the concept of 'early burning' hence their doing it at wrong times and causing fierce fires. Local leaders therefore suggested

that farmers should be enlightened on early burning so that they could use it as a tool to prevent their fields from being destroyed by late fires. At least 20% of the local leaders thought that early burning was a good option.

Another suggestion made by 47% of the local leaders was that of creating firebreaks around the fields and also ensuring that the trees were spot weeded on time. They all promised to work hand in hand with their people to ensure the success of improved fallows by ensuring that the offenders were taken to task.

5.5. Dissemination pathways

5.5.1. Overview of dissemination pathways

Three pathways were considered in this study namely the agricultural extension officers, farmer trainers, and the local traditional leaders. Dissemination of the improved fallow technology in Eastern Zambia was used as a case study for evaluating these pathways. The major objective of this study was to establish which of these pathways could ensure the effective dissemination of agroforestry technologies to the farmers in a cost-effective way. One assumption is that farmers have not taken up improved fallows because of lack of knowledge of its existence as well as benefits. The conventional agricultural extension service has been reported to fail to disseminate improved fallows to the farmers, which is why alternative pathways have been sought. In this study therefore they were used as a control for measuring the effectiveness of the other two pathways. The circumstances under which these dissemination pathways operate vary greatly.

In an attempt to establish an effective pathway for disseminating improved fallow technology, and perhaps any agroforestry technology, farmers and the extensionists were asked to share their views on which pathway they thought to be effective, as discussed below.

5.5.2. Agricultural extension officers as a pathway

Of the 296 farmers sampled, 55% did not see extension officers as an effective pathway for disseminating agroforestry technologies because of their poor track record in the past. Some thought they were not dedicated to their work but only interested in earning a salary at the end of the month. To the contrary, 45% felt that these extensionists were capable of disseminating improved fallows considering that they were well trained and experienced with working with farmers. These farmers were aware that resources limited the agricultural extension officers' work because the government did not provide them. Similarly, Hedden-Dunkhorst and Mollel (1999) reports how the unfavourable structures and lack of financial resources, skills and motivation of extension personnel have negatively impacted on agricultural development in South Africa.

Agricultural officers also felt that sometimes they did not have enough new technologies to disseminate to the farmers. They believed that research had failed them because it took time to develop some workable technologies and sometimes, the technologies seemed irrelevant to the farmers' needs. Farmers have not also played a role in diversifying the extension service in that they have not given feedback to the extension officers about their needs so that these could be a basis for designing extension messages. They have criticised the service without helping to seek solutions on how best the service could assist them. Perhaps there has been no forum created by extensionists at which such issues could be tabled. The agroforestry researchers in Chipata have provided a feedback loop through which farmers could share their experiences in working with improved fallows. This has enabled researchers to address issues as they come from the farmer's fields.

The agricultural extension system in Zambia is faced with many challenges but most of all is their inability to meet the demands of the extensionists' requirements in the field due to over-stretched public sector budgets. As a result of their shortcomings, organisations intending to reach the farmers with new technology have sought alternative pathways that could be effective and institutionally sustainable. In many developing countries, use of farmer extensionists is being tried. Scarborough *et al.* (1997) reports of

such cases in Latin America and Asia whereby farmer extensionists are used, not only in areas where agricultural extension has failed but also where there have been no such services. In the case of improved fallows in Eastern Zambia, the use of farmer trainers and that of local leaders as alternatives has been considered.

It appears that the government has failed to meet the demands of extension. They have started involving NGOs to assist them to compensate for the shortfalls that the agricultural extension system is faced with. According to Scarborough *et al.*, (1997) for example, when the Indian government felt they had failed to adequately address the needs of farmers – their clients, and also to meet the costs of the extension system, they proposed the idea of collaboration with NGOs which was intended to make the service more client-driven.

The strength of the government system lies in its spread throughout the country from national to camp level, with extension officers working at all the different levels. Any NGOs that wish to compensate for the governments' shortfalls must therefore take advantage of the existing system to benefit as many farmers as possible. What the government could do is use the findings made by NGOs in the areas they operate to address the problems raised. They could also provide technical assistance and facilities.

NGOs have advantages over government departments in that they are flexible (Maddock and Wilson, 1994; Pretty, 1995). They are able to implement the participatory extension approach more easily by developing innovative participatory methods, which allow them to learn from farmers. This learning process helps to address the technology gaps that might exist among farmers, researchers and extensionists.

Even though the government might depend on the external funding from the private sector, they must also be mindful of the short-term funding patterns of the NGOs. Many development projects run by NGOs in the developing countries are initiated and driven by external donor organisations. Sometimes even the governments departments' funding is from such external sources. While such funding must be appreciated, it does not offer sustainable solutions since it is withdrawn within the short-term, usually resulting in

programmes collapsing (Duvel, 2000). To ensure continuity of the agricultural extension service, NGOs involved with extension should not work in isolation but always work with or through the government. They could for example assist with training agricultural staff in methodologies that lead to a farmer-based approach. They could also plan activities together so that they avoid duplicating efforts in the field, and hence use resources more efficiently. The government must however find lasting solutions to their funding problem. Some of the solutions that have been suggested by Hedden-Dunkhorst and Mollel (1999) include: the introduction of the participatory approaches, seen as a way to increase coverage, obtaining commitment from the farmers and making extension programmes more relevant; and also consider privatising the service, although this is likely to marginalise the small-scale farmers.

It is beneficial for the NGOs to collaborate with government. However, there are persistent problems that have been reported regarding such collaboration (Pretty, 1995; Scarborough *et al.*, 1997). There is often a lack of trust and deep suspicion from either side. There are also problems of ownership and control of resources and sometimes even their objectives and visions differ.

To ensure that collaboration is strengthened, the government must put in place clear policies at both the national and local levels. At the outset, the agenda and parameters of collaboration should be put right. Policies that allow farmer participation in planning, implementation and evaluation of the extension programmes must be strengthened. The current consideration of the PEA is a step in the right direction. However for the PEA to be successful, agricultural institutions will need to improve their ability to learn. The roles of the professionals need to be that of a facilitator (Pretty, 1995), which in practice should depend on the constraints that farmers face.

Given the erratic funding of the agricultural extension service by the government, and the dependency on external funding, it was difficult for this study to measure the effectiveness of the service and consequently to compare the cost-effectiveness of the pathways. However the conventional agricultural extension service could generally be said to be ineffective in the sense that the service they provided was considered

inadequate and inaccessible by the farmer clientele. Farmers expressed their dissatisfaction with the service and felt that they had been failed by the service because they usually received little or no help when they needed it most. They indicated that they had little contact with the agricultural officers, sometimes none at all if there was no officer in their area. Based on the farmers' views, one would conclude that the agricultural extension service has failed to perform to expectation.

However the extension service cannot be completely discounted as a dissemination pathway since even when lack of resources hampered them, they still fostered the scaling out of improved fallows. They have done so at a very slow rate but still in a straightforward manner. What seemed a drawback in their extension process was a lack of a feedback loop from their clientele. It is necessary to introduce or intensify the component that enables the assessment of staff performance and the monitoring and evaluation of the whole system (Hedden-Dunkhorst and Mollel, 1999), and also to involve all stakeholders at an early stage if extension should have impact on the livelihoods of the people. The importance of monitoring and evaluation at every stage of a programme is to improve or redefine what has been done already based on reliable information about performance (van Gelder and O'Keefe, 1995).

Extensionists should be accountable to their clientele by becoming more responsive to their needs and interests. As officers currently remain accountable to the national extension service, which does not monitor their progress effectively, they remain reluctant to perform even the tasks that they could do without any resources. Extensionists seem not committed to the development of the farmers, even though they are employed to do so. For PEA to function effectively, in a situation where the extension officer is used to playing the role of a teacher, skills training would be beneficial. Officers have to become learners within the extension process. van Gelder and O'Keefe (1995) propose careful selection criteria of officers to be involved with participatory extension, which includes:

- *“Empathy for the way people learn and are motivated*
- *Willingness to use own initiative*
- *Able to speak the language of the farmers*

- *Prepared to work under circumstances with very few facilities, and*
- *Possessing good communication”.*

5.5.3. Farmer trainers as a pathway

Although the farmer trainers had only been working as extensionists for two years at the time of the survey, farmers already talked highly of them. Seventy-six percent of the farmers felt that farmer trainers were a breakthrough for extension of improved fallows while 24% felt unable to comment because they had had little contact with these trainers. Forty percent of the agricultural extension officers also felt that the trainers were the best and most effective pathway at the moment because they managed to reach even areas that themselves had not accessed before. They were pleased to note that these trainers had come from amongst the farmers themselves and would therefore be better able to understand some of the difficulties their fellow farmers faced.

The only concern the agricultural extension officers and the local leaders had about the farmer trainers was their inadequate training in agroforestry technologies. They were worried about information distortion if the trainers were not given enough training to equip them for the challenges they would face in the field with other farmers. They therefore advocated more training courses to be organised for them on a regular basis so that they could keep abreast of new experiences. There was a general observation made by the extension officers that they saw a decline in the trainers' enthusiasm compared to the way they appeared when they first started to work. This could be as a result of the constraints that they have been faced with in their day-to-day operations as discussed in section 5.3.7 above.

The greatest strength that the trainers have is their ability to experiment with the technology with the farmers to determine its suitability to their local conditions. By merely being involved in the practice, trainers become more convincing to farmers. In a monitoring exercise in Chipata District, it was observed that those farmer trainers who had prior experience of planting improved fallows had encouraged more of their farmers to plant than had the new trainers (Katanga *et al.*, 1999). Perhaps in future, a person's

involvement with the technology could be used as one of the criteria for consideration as trainers. Scarborough *et al.* (1997) describes cases in India where extension volunteers try out an idea themselves to test its relevance to the local conditions before others can adopt it.

The success of farmer trainers would vary depending on external influence. External conditions such as national economic policies would undermine local efforts and disrupt some components of success (Pretty, 1995). Whether the success that the farmer trainers celebrate will be sustainable is not known because the period that they have been involved with improved fallows is too short to ascertain that. Many challenges face them and they could only be able to understand if they focused on the procedures and processes that brought about their current impacts. It is from these that they can draw lessons to lead to further improvements. Farmer trainers have potential to be sustainable because they are drawn from the communities from which they live. They should work towards building local foundations such as groups and associations, which would allow them to continue pursuing agroforestry even when they would have no external support (Pretty, 1995).

As with the case of the conventional agricultural extension service, it was not possible to establish the cost of the various extension activities that were undertaken so far. It however could be cheaper than using the government service in that there were no costs incurred as salaries for the farmer trainers, only transport to attend other activities such as meetings and workshops on an occasional basis. The farmer trainers however had the advantage of being able to reach more farmers because they were widely spread, even to some of the areas where agricultural extension service have not been able to reach. They were also able to easily reach more farmers because they lived among them. Other advantages of using farmers as disseminators of agricultural technologies also reported by Scarborough *et al.*, (1997) in Latin America and Asia include the following:

a. Language

Farmer trainers are considered to be at an advantage because they speak the same language as their colleagues. This eases communication and understanding of the technology that is being disseminated.

b. Relevance

Farmers and the trainers face the same constraints, and have similar potentials and aspirations. This makes it easier for the trainers to understand the difficulties that their fellow farmers might encounter, better than the external extensionists would.

c. Availability

Since the trainers live among the other farmers, it is possible that farmers will approach them anytime they are faced with problems related to improved fallow practice. Some of the agricultural extension officers live far from the areas where they operate. This makes it difficult for the farmers to reach them except when they have a planned meeting. Certain challenges that farmers are faced with require immediate attention and if trainers avail themselves to the farmers at all times, they will become more useful than the other extensionists.

d. Accountability

If the farming community were to contribute to the working costs of the trainers, for example in the provision for bicycle spare parts or even transport money to enable them travel to attend workshops, they could hold them accountable for the work they were doing. It is difficult now for the farmers to hold the trainers accountable because they are always on the receiving end. However, trainers are normally committed to serve their people to help alleviate the poverty problems that the majority of the rural farmer's face.

e. Credibility

Since farmer trainers have the same background, and farm under similar conditions as other farmers, their demonstrations of the new technologies and management practices could be more convincing and meaningful compared to those done by professional extensionists. They should therefore be the first ones to experiment on their farms for others to see their success.

f. Sustainability

More importantly, use of farmer trainers could be more sustainable because they would be able to continue pursuing agroforestry technologies even after the supporting agencies are gone.

Based on the above advantages, the farmer trainers might be critical to the success of improved fallows. It is however necessary to assist them in understanding their roles and responsibilities, which could potentially be more than what they do at present.

Some farmer trainers have taken the role of a teacher, as previously done by the agricultural extension officers. Farmer trainers should act as links, facilitators of development, and role models to other farmers, experimenters, and more importantly, they should be able to continue with the work even when there is no external support. It is therefore important to put in place a system that will assist the trainers to understand their roles from the outset. They too, need to be taught the participatory approach.

The participatory approach often focuses on the expressed needs of farmers' groups and its goal is increased production and an improved quality of rural life (FAO, 1988). Its implementation is often decentralised and flexible. The number of farmers actively participating and the sustainability of local extension organisations measure success. The extent to which farmers participate in all aspects of planning and implementing the programme is directly related to its success (Axinn, 1997).

There did not seem to be a proper monitoring and evaluation system in place for dissemination of improved fallows by farmer trainers. If DWDA are to measure the successes of farmer trainers in future, they need to initiate such a system. An attempt was made to ensure that record keeping was up to date and regular review meetings were conducted. However, not all trainers attended these review meetings as they were only limited to those trainers that were selected by DWDA. There must be a forum created whereby every trainer for improved fallows will be in attendance to share experiences equitably.

DWDA requires incorporating a participatory monitoring and evaluation (PM&E) system in the dissemination process of improved fallows. PM&E, like other conventional approaches of monitoring and evaluation, measures changes resulting from specific interventions, but additionally stakeholders who are directly or indirectly involved in the programme take part in selecting indicators to measure changes, in collecting information and evaluating findings (Estrella *et al.*, 2000: 6). Implementing PM&E however requires such investments as time, financial and human resources. So far many funding organisations and NGOs, operating in developing countries, have used it too. For example, CARE Zambia is using a form of PM&E in the Southern Province of Zambia (Estrella *et al.*, 2000: 150-161). Scarborough *et al.*, (1997) demonstrates how such a system has been used in Vietnam. They explain how undesirable the conventional approach of setting targets beforehand could be for measuring effectiveness of farmer-led extension. DWDA will need to seek advice in developing a suitable PM&E for their use.

The selection procedure of these trainers should also be streamlined. Scarborough *et al.* (1997) has reported on the selection procedure used in some parts of Asia and Latin America, and also indicated the problems encountered in deciding when and who should select these trainers. In the case of Zambia, these trainers were hastily selected because of the urgent need for them to take up the challenge of disseminating improved fallows. Even though the farming community was involved in selecting them in a few cases, this was limited to only those farmers who belonged to the women's groups. While there are great advantages in allowing the local people to select their trainers, it is also important to ensure that those farmers with certain qualities are selected. Some of the characteristics

to be considered ideal for a farmer trainer in Zambia as used elsewhere (Scarborough *et al.*, 1997) would be as follows:

- Live on the land where they serve as farmer trainers
- Be a successful demonstrator
- Be enthusiastic and interested to experiment, share, teach and learn
- Be literate so as to theoretically and practically understand the concept
- Be honest and responsible
- Be willing to attend review meetings
- Have adequate time to help others
- Possess good communicative skills (van Gelder and O'Keefe, 1995).

Based on the above strengths, farmer trainers currently appear to be making impact in disseminating improved fallows in Eastern Zambia. They have so far used few resources and also managed to reach many farmers even in the remote areas. They have however not done so in isolation from the agricultural extension service. Since the government extension service is weakened by the inadequacy of operating funds, it is important to emphasise the use of trainers who have shown potential to disseminate even without much investment. This however does not imply that the trainers would have to work independently but that they should be able to collaborate with other stakeholders, NGOs included. If the participatory approaches were adopted, the problem of collaboration that seemed common among the disseminators of improved fallows would not exist.

5.5.4. Local leaders as a pathway

Although local leaders were originally considered as potentially an alternative dissemination pathway, this study found that they were the least involved with dissemination of improved fallows. The farmers' view of their local leaders as a dissemination pathway were mixed, with only 23% of them having considered them as a possibility. The other 77% only thought of them as fellow farmers who also needed to learn about the technology. They however did not refute that they could be trained to become effective extensionists but were concerned that engaging them as extensionists in

one field would bias their decisions in other developmental areas. The community members were happy to have their local leaders involved in workshops, courses, meetings and field days as a way to enlighten them about the technology but not as a route towards becoming extensionists.

The local leaders' authority and influence was however considered as strength for mobilising their subjects to participate in extension activities. They could assist to mobilise farmers whenever extensionists called upon them. Even the local leaders themselves admitted that they could only help to mobilise the farmers to attend such activities but not to actually be the ones disseminating the technology to farmers. They saw themselves more as facilitators and not disseminators. The bureaucracy in meeting with the local leaders is also a hindrance in itself as it restricts interaction with them. Disseminators require being accessible to the farmers at all time. Extensionists, (both government extension and farmer trainers) could therefore collaborate with these leaders whenever they were to work in an area and not necessarily involve them in activities that would jeopardise their authority. Local leaders could contribute to disseminating improved fallow through planting some themselves so that their subjects would emulate them.

How effective the local leaders were as a dissemination pathway could not be established since none of them admitted to having done so before. Even their subjects confirmed that they had not yet encountered a situation where their leaders had helped to involve the farmers in improved fallows. Chiefs were completely dismissed on the grounds that they had no direct contact with their people except perhaps during cultural events. While farmers appreciated their involvement in decision-making by virtue of their authority over the land, being considered as disseminators was considered unacceptable and inconceivable.

The local leaders were not recommended as disseminators mainly based on their not being easily accessible to the farming community. However, when participatory approaches are adopted, they will have their own role to play such as encouraging full participation of their subjects in extension activities. The success of the whole

dissemination programme for improved fallows will therefore require the use of a combination of the three pathways and also different extension methods discussed.

5.6. Suggested criteria for evaluating the effectiveness of dissemination pathways

The discussion in section 5.5 above has been a general overview of the perceived effectiveness of the three pathways namely, the agricultural extension officers, farmer trainers and the local traditional leaders. Although it was difficult to draw conclusions on similarities in the pathways, some commonality can be established which could be used as basis for judgement of their effectiveness. The points below are considered as criteria that can be used to measure for effectiveness when deciding which pathway to use. This list is however endless and can therefore be improved upon if and when necessary. The point-rating system can be used in conjunction with these criteria to weigh the balance of one pathway against the other.

- Knowledge of the farming community
- Relationships of trust between extensionists and the farmers
- Agricultural extension experience
- Language used for communication with the farmers
- Ability to communicate with the farmers
- Accessibility of the farmers to the extensionists
- Distribution of gender among the extensionists
- Available financial resources for undertaking the extension activities
- Ability of the extensionists to put to practice the technology that is being promoted
- Incentives available for the extensionists e.g. whether the salaries are paid or not
- Level and nature of farmer participation in extension activities.
- Size of the farming community to be served
- Mobility of the extensionists
- How flexible is the extension system
- Ability of the extensionists to mobilise groups of farmers

6. CONCLUSIONS AND RECOMMENDATIONS

6.1. Conclusions

This study was prompted by the need for improved fallow technology to reach the farmer clientele in a quick but effective manner. Improved fallows have been found to alleviate the soil fertility problems that most farmers experience in Eastern Zambia (Kwesiga and Coe, 1994; Kwesiga *et al.*, 1999), and yet many farmers have not adopted them. At the outset, it was assumed that farmers were not taking up improved fallows because of lack of knowledge. To the contrary, this study found that 92% of the farmers interviewed were aware of the improved fallow technology but were not taking it up for a number of other reasons. A total of 33% of the sample had initiated improved fallows on their farms. Farmers did acknowledge that, previously, lack of knowledge could have contributed to their not participating in improved fallows, but not now when farmer trainers have been able to reach most of them.

The major extension methods that have been used to disseminate improved fallows to the farmers are meetings, demonstrations, training courses and field days. The agricultural extension officers have also used such methods as distribution of leaflets, 'look and learn' tours for the farmers, and workshops. Meetings have been used extensively because of the ease of organising them. Farmers in Zambia like the field days most because they are able to appreciate the benefits of improved fallows when they can see a positive effect on the farm. Pretty (1995) found this to be true of small-scale farmers in general. However, these field days have not been regularly organised and have been biased to areas where farmers have been involved with fallows for some time. When resources have been available, both extension officers and researchers have worked together to transport farmers to the demonstration fields at a distance but transport has limited the number of farmers that have attended. Most of the farmers who attended field days have attempted to plant improved fallows.

When researchers initially obtained positive results from the experimental trials, they depended only on the conventional agricultural extension service to share it with the

farmers (Ngugi, 1988; Mafongoya¹², pers. comm. 2000). Apparently the dissemination process was slow, and so was the adoption rate. This study found that although 33% were participating, only 10% of the farmers have adopted improved fallows in the last 10 years, these being the ones who had gone past the trial phase and had replanted fallows after seeing the results. The slow rate of adoption observed in the field prompted researchers to consider alternative pathways. These included the use of farmer trainers and also local leaders as dissemination pathways.

Although local leaders were originally included in the evaluation process, this study found that they have not been involved in disseminating improved fallows and were not seen by the farmers as suitable extension agents. Some have been involved in workshops and various extension activities but only for consultation or as beneficiaries. They have not assumed the expected role as disseminators. There are roles however that these local leaders can play. These relate to enforcement of by-laws that concern free grazing during the dry season as well as control of fires that destroy farmers' fields. This study established that by-laws to that effect existed but needed to be enforced to protect farmer's fallow fields. Generally, if participatory approaches are adopted in the dissemination process, then local leaders will be an important stakeholder due to their interest, influence and authority. Local leaders could also provide encouragement to their people by practising improved fallows on their farms and also discussing the technology whenever they hold village development meetings. Functional, interactive and self-mobilisation participatory approaches that are described by Pretty (1995:172-3) could be appropriate ones since they allow full participation of all stakeholders.

The second objective of the study was to evaluate the cost-effectiveness of the dissemination pathways. This was not achieved because it was not possible to collect information on the costs that have been incurred to run these programmes to date. The third objective of the study was to determine an effective dissemination pathway for improved fallows among the existing ones. Some of the aspects that were considered in evaluating the effectiveness of a particular pathway were:

- The adequacy of the service they were providing

¹² P. Mafongoya, Project Leader, ICRAF, Chipata, Zambia. August, 2000.

- How accessible the service offered was to the farmer clientele
- How satisfied the farmers were with the service provided to them and,
- Whether the service was equitably distributed.

This study found the conventional agricultural extension service to be ineffective because it was not able to meet the needs and interests of its farmer clientele. Poor performance of the service is attributed to the poor funding extensionists receive from the government whose public sector budget is over-stretched. Mitti *et al.* (1997) also reported failure by the agricultural extension service and attributed this to the rigid and costly methods adopted, particularly the training and visit system that was used in the 1980s.

In light of the failure to effectively fund the extension service, the government has allowed some NGOs to reach rural farmers in collaboration with the government field officers. Despite the involvement of NGOs, problems within the agricultural extension service have persisted due to lack of trust and deep suspicion among partners. There are also problems of ownership and control of resources, and sometimes, even differences in objectives and visions. Scarborough *et al.* (1997) describes the same constraints in a review of the roles of NGOs in agricultural development in Latin America and Asia. Since the conventional agricultural extension service has failed to meet the needs of the farmers on its own, it needs to establish strong ties with institutions that can provide for its financial shortfalls while it provides the technical input and extension facilities. Extension officers also need to learn more about participatory approaches, which allow them to play a role of a facilitator rather than that of a teacher. Pretty (1995:190) advocates abandoning, “*the literal meaning of extension, as it implies passing something from one who knows to one who does not know*”. He also challenges extension institutions “*to institutionalise approaches and structures that encourage learning*” rather than teaching.

Although too early to give all credit to the farmer trainers in this instance, this group appears to have clear-cut advantages over the other two pathways. They live together with the other farmers, speak the same language, share the same culture and are also small-scale farmers like everyone else. Since other farmers select them, they are likely to

influence farmers' decisions in a more effective manner than did the agricultural extension officers who were seemingly imposed on the people. Scarborough *et al.* (1997) reports similar successes of farmer extensionists in Latin America and Asia, especially in areas where other extension officials do not exist. The challenges that these trainers have faced have not been different from those faced by the agricultural extension officers. Mobility seems the most prominent problem but one that can easily be solved by limiting the area that each trainer is expected to cover. Some trainers who were previously not active farmers have also been faced with problems of not being easily accepted as trainers in the villages where they originate. Farmer trainers therefore need to demonstrate to the other farmers that they can be leaders in the adoption process of improved fallows by ensuring that they manage their own fallows effectively.

There is need to consider providing incentives to these trainers so as to improve their morale. It is not for this study to dictate what form the incentives should take but institutions that assist with funding could develop some package based on the available budget. It could be best if farmers paid for the service that they receive but considering the economic status of the farming community, they would not afford to do so. Farmer trainers need to be aware that incentives would vary depending on the nature of assistance available at any given time. The incentives should be used to assist trainers to offset either travel costs or to hire labour to work on their farms while they serve other farmers. The issue of incentives, especially that of paying them a fee has been debated in Latin America and Asia, where it was felt that farmer extensionists who were paid had to work either part or full time, with those who volunteered only devoting a small portion of their time to extension (Scarborough *et al.*, 1997). The form that is finally adopted will depend on the capabilities of the institutions involved to offer what they can afford. So far, farmer trainers have managed to spread the information about improved fallows effectively and the number of farmers trying the new technology has gone up since their involvement. However, their effectiveness can only be appraised with time, when most farmers have adopted the technology.

Regular training is an important element in any extension service. Farmer trainers need to acquire new skills that will enable them to function effectively. They need skills that

would assist them to implement the participatory extension approaches, which are interactive and empowering. They also need to work with other farmers who do not belong to any group so that they cut across the whole farming community. Alternatively, they could encourage them to join existing groups or simply help them to form other associations, which could enable them to dialogue. In general, it has been found that groups in rural situations provide a better contact and focal point for promotion of various activities than individuals (Pretty, 1995). If the purpose of involving farmers as extensionists is to overcome some of the inefficiencies that have dominated the conventional agricultural extension system, then participatory approaches should be adopted. Mere farmer attendance at these extension activities is not sufficient to warrant being considered as participation. All stakeholders need to participate from the planning stage through to implementation, and feel responsible for the outcome.

If participatory approaches are seriously considered in the dissemination of improved fallows, then farmers and all the three dissemination groups discussed in this study have their own roles to play in the process. It is these roles that need to be clearly established and understood in order to ensure that dissemination of improved fallows results in adoption, so as to improve food security and eventually the general livelihoods of the people. Farmer trainers will be required to work closely with conventional agricultural extension officers to take advantage of the expertise that they have, while extension officers also need to understand the people for whom they will work. Both the local leaders and farmer trainers will be their allies in the process of extension. Most importantly, each pathway must establish a participatory monitoring and evaluation system that has a good feedback and modification technique.

6.2. Recommendations

The following actions are recommended to ensure that improved fallows become an accepted agricultural practice in Zambia:

- Government to put in place a plan to deliberately promote improved fallows or agroforestry in general just as much as they have done for other agricultural technologies.
- There is need to emphasise and show the advantages of improved fallows in a way that is clearly understood by the farmers.
- The nature of the message about improved fallows that is passed on to the farmers needs to be evaluated to ensure that it is in a form that is easily understood.
- Researchers should address the farmers concern of the food value of fallow species when they are considering alternative species for the same.
- Seed provision and its delivery on time to the farmers should be addressed to encourage more farmer participation.
- Research on pests and diseases of improved fallow species should be intensified.
- The issue on free grazing to be forestalled.
- Unequal land distribution discourages some farmers from participating in improved fallows. It is necessary to study the land tenure system to see if it has an influence on decisions to take up improved fallows.
- Since the government is unable to fund the agricultural extension service fully to enable it meet its intended objectives, it could create a system that allows NGOs and the existing agricultural extension system to effectively work together.

- Additionally, the government may allow for an extensive evaluation of the extension system to establish how feasible to continue with it.
- Participatory approaches are important in the process of dissemination and should be emphasised by involving all stakeholders from the planning through to the implementation of the dissemination so that they will feel responsible for the outcomes of the programmes.
- Effective use of participatory approaches will require that extensionists be provided with skill training that will assist them to understand and undertake their new roles.
- Since there are many partners involved with disseminating improved fallows, they need to collaborate and assign roles and responsibilities to each group if they are to achieve their objectives. To improve collaboration among them, the roles of each partner should be streamlined and made clear to each of them at the outset.
- Initiation of an effective participatory monitoring and evaluation process for both the conventional agricultural extension system and farmer trainers by all institutions, which will provide good feedback and also informed modification techniques.
- Critically examine the selection criteria for farmer trainers so that they are considered on the basis of their potential to participate in experimentation and use of the technology, since they should act as model farmers to others.
- Encourage farmers to join existing groups or simply form other groups or associations that allow for them to dialogue. Extensionists must therefore be encouraged to work with large groups to allow them to reach many farmers with few resources, and in case of farmer trainers this will also enable them to save time to work on their farms.

- The promoters of improved fallows must consider the issue of incentives for the farmer trainers seriously.

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APPENDICES

APPENDIX 1: QUESTIONNAIRE FOR EVALUATING DISSEMINATION OF IMPROVED FALLOWS IN EASTERN ZAMBIA

FOR THE FARMERS (YA A LIMI)

Time of interview (Nthawi): _____

Date of interview (Tsiku): _____

District (Boma): _____

Village (Mudzi): _____

Name of respondent (Dzina la ofunsidwa): _____

1. Sex of respondent (Kodi ofunsiwayo ndimwamuna kapena mkadzi(tick))

Male (mwamuna)	<input type="checkbox"/>	Female (mkadzi)	<input type="checkbox"/>
-------------------	--------------------------	--------------------	--------------------------

2. Age of respondent (zaka zakubadwa za ofunsidwa)

3. Marital status (Kudi ali ndi banja kapena alibe) (tick)

Single	<input type="checkbox"/>
Married	<input type="checkbox"/>
Separated	<input type="checkbox"/>
Divorced	<input type="checkbox"/>
Widowed	<input type="checkbox"/>

4. Number of children (Ali ndi ana angati)

Male (amuna)	<input type="checkbox"/>	Female (mkadzi)	<input type="checkbox"/>
--------------	--------------------------	-----------------	--------------------------

5. Number of extended family members living with you (Kodi anthu abanja osungidwa pakhomo ndiangati)

Male (amuna)	<input type="checkbox"/>	Female (akazi)	<input type="checkbox"/>
-----------------	--------------------------	-------------------	--------------------------

6. Level of education of respondent (mapunzilo ya akulu yomwe anapitako)

7. Ability to read and write (kodi atha kuwerenga ndi kulemba) (tick)

Read English (kuwerenga chingelezi)		Write English (kulemba chingelezi)	
Read local language (Kuwerenga colankulidwa)		Write local language (kulemba colankulidwa malowo)	

8. Source(s) of income for the family (list in order of priority) (njila yopezelamo ndalama zosewenzetsa pa nyumba)

- a. _____
- b. _____
- c. _____
- d. _____
- e. _____

9. How long have you lived in this village (kodi mwankalamo myaka ingati muno mumudzi)

10. Have you always been farming (kodi nthawi yonse mulima) (tick)

Yes		No	
-----	--	----	--

11. What is the size of your farm (kukula kwa munda wanu)

Lima		Acres		Hectare	
------	--	-------	--	---------	--

12. Have you heard about improved fallows (kodi munamvapo za ulimi obyala mitenga yo bwezera nthaka) (tick)

Yes (inde)		No (iyai)	
------------	--	-----------	--

If no, go to question 21 (ngati yayi, pitani ku 21)

13. How did you hear about improved fallows (Kondi munamva bwanji za ulimiyo)

Farmer	
Farmer trainer	
Agriculture extension officer	
Other (Specify below)	

Specify: _____

14. When did you first hear about improved fallows (kodi ndiliti pomwe munamva za ulimiyu)

Month: _____. Year: _____

15. What is the size of the farm on which you have tried the improved fallow (kukula kwa munda momwe muyetsa ulimi wa mitengo yo bwezela nthaka)

Lima		Acres		Hectares	
------	--	-------	--	----------	--

16. Year in which you first attempted to plant improved fallows (chaka comwe munayamba kuyetsa kugwapo panjila yaulimiyo)

17. For how many years have you planted improved fallows (mwakhala muli kusewenzetsa njila yaulimiyo padzaka zingati)

18. Who decided in your family that you should start planting improved fallows (ndani anabweretsa ganizo yolima mitengo yobwezera nthaka pa banja lanu)

19. How many family members are involved with improved fallow management (Clearing, planting, weeding, harvesting, nursery, etc.) (ndi anthu angati omwe amathandizila kusamalila munda wanu wa mitengo pa banja lanu)

20. Why are you not planting improved fallows

21. Who is the agricultural extension officer for this area (Name) (ndani mulangizi wa ulimi malo ano (Dzina)

22. From which organisation is your agricultural extension officer (Kodi mulangizi wanu wa ulimi wa mitengo asewenza kuti)

23. Have they talked to you about improved fallows (tick) (kodi anakambilanako nanu za ulimi wa mitengo yobwezela nthaka)

Yes		No	
-----	--	----	--

24. What other technologies have they talked to you about (zina zamene anamipunzitsa nizabwanji)

25. How many times do they visit you(tick) (kodi amuyendelani kangati pamwezi kapena pa mulungu umodzi)

Once a week	
Once a month	
Every 2 or 3 months	
Never	
Other (Specify below)	

26. What language do you use when you are with the extension agent (kodi mumasewenzetsa chilankhulidwe cotani pokambilana ndi mulangizi wanu)

27. Do you ever go to visit the extension officer for anything (kodi mumaendako mukuona alangizi a ulimi anu)

28. How many meetings, field days or demonstrations have you attended on improved fallows (munapezekako kangati kumusonkano, kuchioneselo, kumapunziro kapena kuchilangizi)

Activity	1995	1996	1997	1998	1999	2000
Meetings						
Field days						
Courses						
Demonstrations						

29. How far do they take place from your house (kodi nikutali bwanji komwe izi zichitikila kucokera pa khomo panu)

30. If have not attended, why (ngati simunapezekeko, chinamulepelesani nichiani)

31. What have you learnt from the above contacts on improved fallows (munapunzilako chiani)

32. What have you improved in your farming system as a result of the contacts (kodi niza bwanji zamene mwawamisa muminda yanu mulandu wa zamene munapezekako)

33. What tree species are you planting for your fallow (kodi ndi mitengo yotani yomwe muli kusewenzetsa)

Species	Performance

34. Have you tried any other tree species apart from what is growing now (kodi munayesako kubyala mitengo ina kupatululako yomwe musewenzetsa pali pano)

Species (mitengo)	Performance (kakulidwe)

35. How did you select the species to use in the fallow (kodi munasankha bwanji mitengo yosewenzetsa kubwezela nthaka)

36. Do the extension agents discuss with you the management of improved fallows (Kodi alangizi anu amamuthandiza momwe mutha kusamalila mitengo yanu yobwezela nthaka)

37. What is your general feeling about the following in promoting improved fallows (kodi muganizapo bwanji pa aba nga alangizi ba ulimi)

- Agricultural extension officer (camp officers)

- Chief

- Headmen

- Farmer trainers

38. Suggestions of improvement for the agricultural extension service (zomwe muganiza angathe kumuchitilani kupambana pa zomwe amuchitilani palipano)

39. Do you see improved fallows as a viable option to land use problems or it is just one of those projects that have to be implemented? (kodi muganizapo kuti ulimi uyu ungate kuthetsa mabvuto akasewenzesedwe kanthaka, kapena kukhala cabe chinthu comwe muchita kukwanilitsa zomwe muphunzitsidwa)

APPENDIX 2: QUESTIONNAIRE FOR EVALUATING DISSEMINATION OF IMPROVED FALLOWS IN EASTERN ZAMBIA

QUESTIONNAIRE FOR THE EXTENSION AGENTS (PEPALA LA MAFUNSO KWA ALANGIZI A ULIMI)

Time of interview (nthawi): _____

Date of interview (Tsiku): _____

District (boma): _____

Village (mudzi): _____

Name of respondent (dzina la ofunsidwa): _____

1. Sex of the respondent (nimwamuna kapena mukadzi)(tick)

Male (mwamuna)		Female (mukadzi)	
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2. Age of the respondent (zaka zo badwa za ofunsidwayo)

3. Area in which operating (zina lamalo komwe asewenzela)

4. Size of the target group (Number of households) (kukula kwa unyinji wa anthu omwe afuna kusewenzana nao)

Male headed		Female headed	
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5. Objective of the extension being carried out (lingo la nchito yochikila kudalako)

6. Language of communication with farmers (chilankhulidwe cokambidwa ndi alimi kumaloko)

7. Fluency in language (Ukaswili polankhula chitundu cakumaloko)

8. Mobility (means of reaching the target group) (kayedwe poyendela alimi)

9. How often do you visit the farmers (kodi mumayendela pafupi pafupi bwanji alimi anu)

10. How many farmers do you reach per visit/month/year (ndi alimi angati omwe mutha kuyendela patsiku/pamwedzi/pamwaka)

	Male (amuna)	Female (akadzi)
Per visit		
Per month		
Per year		

11. What methods have you used to reach out to the farmers on improved fallows (kodi ninjila yabwanji yomwe musewenzetsa pakufuna kuti alimi agwepo paulimi wa mitengo yobwezela nthaka m'munda)

12. How many farmers were contacted by each method (Male/Female) (ndiangati alimi omwe anagwapo pa ulimi mutasewenzetsa njila zosiyana siyana)

Method	Farmers reached	
	Male	Female

13. How many farmers have received project benefits (inputs, credit, training, etc.) (M/F)
 (kodi ndiangati alimi omwe apezako phindu wa kucokela kwa agulu lobweletsa
 ulimiyu (zosewenzetsa pa ulimiyo, kupatsidwa nkhongole, maphunzilo)

Type of benefit	Number of farmers	
	Male	Female

14. What technologies are you promoting (mupunzitsa nkani zotani zaulimi)

Technology	No. of farmers reached		No. of farmers adopting	
	Male	Female	Male	female
Conservation farming				
Improved fallows				

15. Would you wish to reach much higher a target than you do now (kodi muganizako
 zokhala ndi alimi ochulukila pomwe muganizila tsopani)

Yes		No	
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16. What factors affect your work (kodi nizotani zomwe zivutako pamasebenzedwe yanu)

17. Which is your source of resources for use in disseminating improved fallows (kodi ndani amuthandizani zosewenzetsa panchito yo falisa uthenga na ulimi wobwezela nthaka)

Source (ndani wotandiza)	Type of resource (wotandiza chiani)

18. Are the resources sufficient for your work (kodizomwe mupatsidwa kusebenzetsa zimakwanila bwino)

19. Are you meeting your targets better now than five years ago (kodi m'matha kukwanitsa nchito kulingana ndi momwe mufunila mukalinganiza ndi zaka zisanu zapitazi)

20. How do you explain your answer in 19 above (ntantauzani yonko lanu la mu 19 pamwamba)

21. What is your general overview of the whole extension process for improved fallows (muonapo bwanji pa nchito yonse yo falisa uthenga wa nchito yobwezela nthaka m'munda)

22. How did you know about improved fallows (Nkhani ya ulimi wa mitengo yobwezela nthaka inamufikani bwanji)

23. Have you received any training related to improved fallows (kodi munalandilapo kale mapunziro yokhuzako kunkhani yobyala mitengo yobwezela nthaka m'munda) (tick)

Yes		No	
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24. What kind of training (kodi anali maphunziro abwanji)

25. Duration of training (maphunzirowo anakwanila nthawi yolalika bwanji)

26. Have you encountered any constraints with disseminating improved fallows (Kodi mwapezako mabvuto pakufalitsa uthenga wa mitengo yobwezela nthaka m'munda)

27. What other factors affect adoption of improved fallows? (Nichiani comwe munganiza kuti cibwezela pambuyo kugwapo pa ulimi wamitengo yobwezela nthaka)

28. Comment of the following as pathways for improved fallows (kodi aba bangatandize bwanji kufikilisa utenga wa mitengo yobwezela nthaka m'munda)

a. Farmer trainers _____

b. Chiefs _____

c. Headmen _____

d. Other NGOs _____

APPENDIX 3: QUESTIONNAIRE FOR EVALUATING DISSEMINATION OF IMPROVED FALLOWS IN EASTERN ZAMBIA

FOR LOCAL CHIEFS AND VILLAGE HEADS (MAFUMU ANDODO NDI MAFUMU A PAMUDZI)

Time of interview (nthawi): _____

Date of interview (Tsiku): _____

District (boma): _____

1. Name of the village (dzina la mudzi)

2. Size of the village (number of households)(mumudzi muli mabanja angati)

3. Name of the Chief/head (dzina la mfumu la ndodo kapena mfumu ya pa mudzi)

4. Gender (mwamuna kapena mkadzi) (tick)

Male	<input type="checkbox"/>	Female	<input type="checkbox"/>
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5. Level of education (kodi anapita maphunziro otani)

6. Size of the family (banja niikulu bwanji)

Category	Male	Female
Spouse(s)		
Children		
Dependants		

7. Have you heard about improved fallows? (kodi munamvelapo kale nkhani yobyala mitongo yobwezela nthaka m'munda) (tick)

Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
-----	--------------------------	----	--------------------------

8. When was the first time you heard about it? (niliti pomwe munamva zankhaniyi)

9. From whom did you hear about them? (kodi munamva kwandani)

10. Do you plant improved fallows? (kodi inu munagwapo kale pa ulimi wobyalala mitengo yobwezela nthaka m'munda)

Yes		No	
-----	--	----	--

11. What is the size of your farm on which you plant improved fallows? (kodi munda wanu momwe mubyala mitengoyi niukulu bwanji)

12. Have you attended any meeting, field day or course on improved fallows? (kodi munapezekako kumusonkano, chioneselo ca m'munda kapena maphunzilo a njila yobyala mitengo yobwezela nthaka) (tick)

Activity (cochitika)	Yes	No
Meeting (musonkano)		
Field day (cioneselo ca m'munda)		
Demonstration (munda wa cisanzo)		
Course (maphunziro)		

13. Are people in your village practising improved fallows? (kodi anthu a pamudzi panu anayamba kusewenzetsa njilayi yo byala mitengo yobwezela nthaka) (tick)

Yes		No	
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14. When did they start? (Year) (kodi anayamba liti-chaka)

15. Do you encourage them to plant improved fallows? (kodi muwalimbikitsa pakusewenzetsa njilayi) (tick)

Yes		No	
-----	--	----	--

15a. How do you do it (musewenzetsa njila yotani pakuwalimbikitsa):

16. How best can farmers learn about improved fallows? (ninjila yotani yabwino kwambiri yomwe ingatandize alimi kuphunzila za ulimiyu)

17. How can farmers increase the area under fallow? (kodi chingatheke bwanji kuti alimi akuze minda yao ya mitengo yobwezela nthaka)

18. In what ways has planting of fallows improved the livelihoods of the people in this village? (kodi nichiani chimaonetsa kuchinja pa umoya wa anthu omwe anagwapo pa ulimi uyu pa mudzi wanu)

19. What by-laws do you suggest to control the following constraints to uptake of improved fallows (nimalamulo abwanji omwe angathe kuthandiza kuteteza mavuto olembedwa munyansimu yomwe angabwezele ulimiyu pambuyo)

a. Grazing (kudyewa kwa mitengo ndi ziweto):

b. Fires (kutenthedwa kwa minda yamitengo yobwezela nthaka):

20. What is your advice to other local leaders around the country? (kodi ndimau otani omwe munga langizeko mafumu ena a mudzi pa ulimiyu)

21. How are the agricultural extension officers helping your people to plant improved fallows (kodi alangizi a ulimi atandiza bwanji anthu amumudzi wanu kubyala mitengo yobwezela nthaka)

APPENDIX 4: QUESTIONNAIRE FOR EVALUATING DISSEMINATION OF IMPROVED FALLOWS IN EASTERN ZAMBIA

QUESTIONNAIRE FOR FARMER TRAINERS (PEPALA LA MAFUNSO KWA ALIMI OMWE ALI ALANGIZI)

1. Date (Tsiku)

2. District (boma)

3. Village (mudzi)

4. Name of respondent (dzina la ofunsidwa)

5. Age of respondent (zaka zobadwa za ofunsidwayo)

6. Gender (kodi ndi mwamuna kapena m'kadzi) (tick)

Male		Female	
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7. Marital status (kodi ali ndi cikwati)

8. Size of the family (kukula kwa banja)

	Male	Female
Children (ana)		
Dependants (osungudwa)		

9. Highest level of education attained (maphunziro ya akulu yomwe munapitako)

10. Size of your farm (kukula kwa munda wanu)

11. Activities on the farm (zomwe muchita pa munda wanu)

12. Sources of income for the family (njila yomwe banja imapezelamo ndalama)

13. Do you practice improved fallow (kodi munagwapo panjila yobyala mitengo yobwezela nthaka) (tick)

Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
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14. Have you received training on improved fallows (kodi munalandilako maphunziro pa ulimi wa mitengo yobwezela nthaka) (tick)

Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
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15. What type of training (ndi mapunziro otani)

16. What species are you using (kodi ndimitundu ya mitengo yotani yomwe musewenzetsa)

17. For how long have you been planting improved fallows (kodi mwakala muli kusewenzetsa njilayi pazaka zingati)

18. How many family members work on the farm (kodi ndianthu angati pa banja lanu, omwe amathandinza posamalila munda wanu) (M/F)

Male: _____

Female: _____

19. Hired labour to work on your farm(M/F)/season (aganyu pamunda wanu)

Planting Season	Male	Female
1997/1998		
1998/1999		
1999/2000		

20. In which year were you recruited as trainer (kodi ndicaka canji pomwe muna khala alangi a ulimi)

Year: _____

21. Have you received any training as a farmer trainer (kodi munalandilapo maphunziro a ulangizi wa ulimi) (tick)

Yes		No	
-----	--	----	--

22. How were you recruited (munasankidwa bwanji)

23. How many farmers have you recruited (ndiangati alimi agwapo pa ulimi wa mitengo pambuyo pa nchito yanu) (M/F)

Season	No. of farmers recruited		No. of farmers planted	
	Male	Female	male	female

24. Have you conducted any training, field days and demonstrations for the farmers (kodi munapangapo kale musonkano, maphunziro kapena chionesero caku munda kapana ka munda cabe ka chionesero) (tick)

Activity	Yes	No
Training		
Meetings		
Field days		
Demonstrations		

25. How many courses, meetings, field days and demonstrations have you conducted (kodi mwachitako zingati pa izi ziri munsu)

Activity	Season		
	1997/1998	1998/1999	1999/2000
Courses (maphunziro)			
Meetings (musonkano)			
Field days (chionesero ca kumunda)			
Demonstrations			

26. How many farmers attended (ndiangati alimi anapezekako) (M/F)

Activity	1997/98		1998/99		1999/2000	
	Male	female	male	female	male	Female
Courses						
Meetings						
Field days						
Demonstrations						

27. What topics were covered (kodi ndizotani zomwe zinakambiwapo kapana zinachitika)

- a. _____
- b. _____
- c. _____
- d. _____
- e. _____
- f. _____

28. How did you decide on these topics (kodi nichiani chipanga inu kuti mukambe pa zinthu izi kapena kuchita zomwe zinachitika)

29. What costs do you incur in conducting such activities (kodi mutayapo ndalama zotani pakusewenzana nchito izi)

30. Do you receive any support (kodi mumalandilako thandizo kucokera kwina)

Source (ndani wotandiza)	Type of support (tandizo)

31. Do you encounter any problems in carrying out your duties (kodi mumakumana ndi zobvuta posewenza nchito yanu)

32. What have been your achievements since you were involved with dissemination of improved fallow (kodi nizabwanji zomwe mwakwanilisapo kuchokela pomwe munayambira kufalitsa uthenga obyala mitengo yobwezela nthaka m'munda)

33. What are your future plans (kodi maganizo anu apatsogoro ndiotani)

34. What is your general opinion about this technology (kodi muganizako bwanji pa ulimi wa mitengo yobwezera nthaka).